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Vol. VI. NEW YORK, DECEMBER 19, 1885. No. 25.

WE understand that the Baltimore & Ohio Telegraph Company is now operating over fifty "district telegraph" systems, and is in the main doing a good business with them.

THE Western Union dividend has been reduced to 1¼ per cent., from 1½. Probably 1¼ is all that the company can pay, and is in itself not bad, but the declaration of the lower rate is attributed to some new "bear policy" on the part of Mr. Gould.

THE point raised in the contention between the Stock Exchange and the American Cable Company is important and interesting, as detailed elsewhere in our columns to-day. It would be well to have the limits of responsible certification defined.

PERSONS interested in telegraphy or in the stock market are still commenting on the remarkable fact that the morning after Mr. Vanderbilt's sudden death, the private wires leased from the Western Union were out of order, while other lines leased from other companies worked as usual. Of course, the failure of the wires put a drag on stock operations, and it is thought by some to have served materially to keep prices up just when a nervous feeling might have intensified into panic. It may have been a happy coincidence, but it was very singular—wasn't it?

AT Kansas City a few days ago, the gas-works blew up, and since then the people have been without their supply of gas. Recourse has been had to other illuminants, and a vigorous demand has sprung up for the electric light. It is worthy of note that months must pass before the works can be restored, while an electric light plant to supply hundreds of customers can be installed in a week, and new circuits can be run in a day. Having once learned the value of the electric light, the Kansas City people will continue to use it largely.

THE communication which we print in another column casts a doubt upon the correctness of the results obtained by the Franklin Institute Committee. It is claimed that the power measurements are too small, and especially those relating to the friction of the machine. Our correspondent, Mr. Heinrichs, has done such good work in this field that his statements demand attention, which will probably be accorded to them by those directly interested. He naturally seeks to defend his own machine from the charge by inferential analysis of comparatively low efficiency, and his argument seems, therefore, justifiable. We hardly imagine that these charges will lead to another test, but the criticism applied to the committee's work may need some refutation.

THE decision of Judge Arnold, in Philadelphia, last week, is interesting to all telephone people. It is decided that the Bell Telephone Company is a common carrier, and is, therefore, bound to allow the Baltimore & Ohio Telegraph Company the same privileges in the use of its telephones as it permits the Western Union or any single individual. The agreement by which the Western Union Telegraph Company is given the right to use the Bell Company's telephone for the transmission of its messages, to the exclusion of the Baltimore & Ohio, is declared illegal and inoperative. The Bell Telephone Company must serve the public without discrimination as respects either corporations or individuals. It is well that the local Bell Telephone Company has already carried this to the Supreme Court, for it is a perplexing question, and one in which it were better for all parties to hear a final decision.

THE project of establishing electric railways in Vienna seems now to be in a fair way of being practically accomplished, the plans of Siemens and Halske having been sanctioned by the authorities. In one of our articles on electric railways, published in the early part of this year, we devoted considerable space to the Vienna project, whose main points it may be well to recall, as the idea presented is a good one. It will be remembered that, in the first place, the system is to consist of alternate underground and elevated sections, according to the contour of the ground. The city is then divided into sections, which are connected together, the central section being traversed circularly and the other touching this central section at different points. It would be humiliating to American enterprise to see a European city provided with a complete electric railway system before any of our great cities, and this feeling should act as an incentive to our capitalists and railroad men, as well as to our electrical engineers.

ONE of our English contemporaries, given to the use of strong language, goes out of its way to advise "that not a single farthing be invested in any new Atlantic cable company, as it is impossible that any return can be realized from such investment;" and it emphatically protests "against any attempt being made to obtain money from the public for this purpose." There can be no doubt that the present number of Atlantic cables is amply sufficient for the traffic; it was so even before the construction of the Mackay-Bennett cables, but we are free to say that the money invested in the latter is paying a fair dividend. Of course, cables with plenty of watered stock find these times of competitive rates very dreary, and thus far we think the new Atlantic cables have had the best of the fight. The gratuitous advice of our contemporary seems, therefore, to be a plea for the protection of the old companies from further interlopers, rather than an altogether disinterested warning. Certain it is that the public will not suffer by the construction of new cables.

IT may not occur to most scientists that the 30th inst. will mark the 225th anniversary of that great organization "the Royal Society." One hundred years before Washington was born, and in those stirring years of civil strife that ushered in the Commonwealth in England, clubs for political, theological and sectarian purposes were formed among men of inquiring minds, while in 1660—twenty-two years before William Penn landed on our shores—the Royal Society was instituted, and "divers worthy persons, inquisitive into natural philosophy, and other parts of human learning, did, by agreement, meet weekly in London on a certain day, to treat and discourse of such affairs." Since then, some of the most illustrious names in the annals of science appear on the rolls of the Royal Society, and for two centuries and a quarter these "divers worthy persons, inquisitive into natural philosophy," have done much to advance the world to its present enlightened position. Our own Franklin Institute, though much younger, has done no less in aiding these grand results.

THE lecture recently delivered before the New York Electrical Society on the use of the condenser in telegraphy calls to mind the fact that apparatus for a long time used only in experimental investigations, can, by a sudden stroke, be elevated to the highest commercial and practical use. Without the condenser submarine cables and long multiplex land-lines, both pole and underground, could never have been successfully worked. A comparison of Mr. Thompson's method with that of Stearns will show that the difference consists principally in the disposition of the condenser. In the Thompson method, the condenser is placed between the main and artificial lines, forming a shunt around the differential relay, a resistance being added to the main line as a compensator. In the Stearns duplex, on the contrary, the condenser has no connection with the main line, forming only a shunt around the resistance representing the artificial line. Mr. Thompson during the course of his remarks claimed that with his method very little regulation was required, balance being maintained very well under greatly varying conditions of the line.

WHETHER the public is or is not inclined to believe Mr. Jacob Hess as regards the intentions of the Underground Wires Commission, some recent remarks of his have our hearty approval and confirmation: "Those who are complaining of the delay in putting the wires underground have little idea of the magnitude of the work or the difficulties to be overcome. In fact, very few persons outside of those who have made a study of the subject have anything like a correct idea of what is required." That cannot be gainsaid. Another remark is this: "Contrary to public belief, there has been a disposition among nearly all the electric companies to comply with the law if some practical plan could be found." Now whatever motive Mr. Hess may have for saying this he has only said what is strictly true. He makes the significant statement that in the cities visited by the commission recently the problem has been struggled with for three years, but that not a pole has yet been taken down. In New York, where the difficulties are greater than anywhere else in the country, there will be plenty of poles three years hence.

A REMINDER will not be out of place or untimely to the effect that the annual convention of the National Electric Light Association will be held in Baltimore on February 10, 1886. The Association has a membership of seventy-five companies and individuals, with a fair prospect of increasing the number to one hundred before the meeting in Baltimore. The various committees are expected to report upon the meeting of the convention. We understand that the report of the Chicago and New York sessions will be ready for publication in a few days—and here the hint may be thrown out that the members might even now begin to think of the next place of meeting after Baltimore. Our own idea, respectfully presented, is that Cleveland would be an excellent place, for a number of reasons. One point, however, to be borne in mind is the choice of a new President, it being said to be Mr. Morrison's wish to resign on account of the pressure of his own immediate work. Should Mr. Morrison be induced, fortunately, to reconsider his determination, there will be no trouble in the matter, but otherwise the choice of a meeting place may depend largely on the availability of a good man in that locality for the office of President.

AT the recent meeting of the American Institute of Electrical Engineers a prolonged discussion was had in relation to the adoption of the revised by-laws. As submitted by the Committee of Revision, the clauses relating to qualifications of members and associates seemed not to be as definite as could be desired, and hence were subjected to change at the meeting. A board of examiners has now been appointed to inquire into the qualifications of applicants, and henceforward this "examining board" may be called upon to pass new applicants. It must be borne in mind, however, that the new rules, according to well-established usage, only apply to those who may hereafter enter the society. We are aware that the classification which has become necessary, dividing the society into members and associates, has caused considerable discontent, but that such a distinction is advisable and even inevitable is established by too many precedents to need any additional support. While the discussion at the recent meeting was most animated and prolonged, it was melancholy to see the meagreness of the attendance. It would be difficult to assign a reason for this, as the object for which the meeting was called was sufficiently important. But the fact that no papers were announced may, more than any other cause, have led to the absence of members. Hence we must reiterate that unless the members of the Institute prepare papers for reading and discussion, the objects for which the Institute was organized can hardly be accomplished. The list of members contains names of such eminence in various departments that the phenomenon presented is indeed a strange one. Mr. Ralph Pope, the Secretary, is doing his best to make the Institute a power for good, and deserves to be seconded by all electricians.

The Profitable Section of an Electrical Conductor for the Transmission of Power.

BY THOMAS WHITESIDE RAE, C. E.

The question was recently put to me whether or no the cross-sectional area of a copper conductor intended to convey a current of some magnitude a moderate distance for power purposes was needlessly large, and I found the investigation so interesting and involving so many generally unsurmised factors that it seemed to me a worthy subject for a monograph.

The amount of power to be circulated in the form of current was 500 horse-power, the length of the circuit 4,000 yards, or 2.27 miles, and the cross-section of the copper conductor 3.25 square inches. The potential of the current was restricted to 120 volts.

The current equivalent of 500 horse-power being 373,000 volt-ampères, it followed that the theoretical value of the current flowing in the circuit would be 3,108 ampères.

This, however, is subject to correction for the loss involved in the conversion of mechanical work into current; which is due to the frictional and electrical resistances of the generating dynamo, and whose minimum—so far as known—is about 13 per cent. It will be prudent and more in accord with other conditions of the problem—to be stated later—to put this loss at 15 per cent., and consequently there may be considered to be a current of 2,642 ampères flowing in the conductor.

It is evident that the flow of any appreciable current in any practicable conductor must evolve heat. If a uniform temperature of conductor is to be maintained, this development of heat must be got rid of by radiation or conduction; or it becomes cumulative and detrimental, by creating a wasteful resistance in the circuit and, in the case of insulated conductors, sometimes destroying the insulating medium.

The latter class of conductor would seem to offer especial difficulties, and the problem is as yet too new to have invited much investigation or experiment. While it is undoubtedly true that the best dielectrics are, probably without exception, the worst conductors of heat and the rates of their efficiency, in this sense, practically unknown, it has also been experimentally demonstrated that insulated conductors have even less tendency to augment temperature under the passage of a current than bare wires. This is a deduction from laboratory tests, and must be accepted only within proper limits. The seeming paradox vanishes when one reflects that the worst possible conductor of heat is dry motionless air, and that the larger periphery of the insulated wire radiates the greater quantity of heat in the same time. The result would be reversed if the two types of conductor were exposed to draughts of wind; but the instance is cited to show that the general formulæ are applicable to both classes. Without being willing to rest for an instant under the imputation of reflecting upon the utility—nay, the indispensableness—of sound generalization, I cannot refrain from calling attention to the prominent part taken by judgment in every problem in physics. Every case may be said to be a special case, and in view of the numberless and unforeseeable influences affecting the temperature of a subterranean conductor two and a quarter miles long, it seems almost finical to be calculating the effect of a few degrees due to current resistance. Nevertheless, the investigation is of importance.

It is presumable that a conductor buried in homogeneous earth and well below the frost line would retain about a uniform temperature all the year round, but that temperature would depend upon the nature of the soil.

It would naturally be one thing for clay, another for sand and another for rock; and none of these could be known except by experiment. In all probability, a conductor of any considerable length would pass through all varieties of soil, across places alternately dry and wet, possibly near steam pipes, and any attempt to assign quantitative temperature to them would be farcical. In such circumstances, the only recourse is to general formulæ, as furnishing—all things considered—as fair an average of the conflicting influences as possible, and one of Clark and Sabine will do as well as any. It is

$$\theta = 0.2405\ R\ C^2\ t,$$

in which

θ = units of heat.
R = resistance in ohms.
C = Current in ampères.
t = time of flow in seconds.

Since the current in this case is practically continuous, t will disappear, and the factor R must be deduced, Clark and Sabine again furnishing the means with their formula

$$R = \frac{1002.4}{w},$$

w being the weight in pounds of a statute mile of the conductor whose resistance is sought.

In the case in question the weight of a statute mile is 65,261 lbs., and its resistance at 60° Fahr. consequently .01536 ohm; making the resistance of the entire 4,000 yards .035 ohm.

Carrying out the operations indicated by the formula, it will be found that

$$\theta = 58756;$$

that is to say, the given current will develop in the given conductor so many units of heat.

If it were conceivable that the substance of the conductor was water and weighed just 58,756 pounds, this would mean that its temperature would be raised one degree Fahrenheit. But its material is copper, whose specific heat is .092 or—familiarly speaking—which requires but .092 of the quantity of heat that water does to affect its temperature equally; and its weight, as has been seen, is 148,320 pounds.

Adapting the result to these conditions, it will appear that the conductor under consideration will have its temperature raised by the current circulating in it, only 4 17° Fahrenheit, above what it would be if out of circuit.

This increment is so trivial with regard to any harmful influence it might exert upon the insulating medium used with the conductor, that search must be made in other directions for the reason which prescribes its seemingly excessive size.

Good gutta percha will endure a temperature of 120° Fahr. before failing, and India rubber 300° Fahr. So the cause sought for is probably supposed to be the reduction of current, and consequently of merchantable horse power, resulting from an increase of resistance by augmented temperature.

The resistance of copper increases $\frac{41}{100}$ of one per cent. for each additional Fahrenheit degree of temperature, and in the case of the predicated current and conductor, the resistance of the latter will be enhanced but $\frac{86}{100}$ of one per cent. For the purposes of discussion, the loss of current due to this augmented resistance will be ignored for the present. To estimate the effect of such increase of resistance from a financial standpoint, the subjoined method is convenient.

The 2,642 ampères of current flowing in the conductor are subject to a farther diminution, before they appear in merchantable shape, which occurs in their transformation by the converting dynamos into horse-power.

It may be safely taken at 17 per cent.; which amounts to the admission that, of the 500 horse-power applied to the generating dynamos, but 70 per cent. may be counted upon returnable, in the same form, from the converting dynamos. One of the postulates of the problem was that at least this proportion of the applied mechanical power should be recovered after having undergone all its transformations, and the loss has been equally divided—which is probably as fair an allotment as possible—between the two conversions.

There should be, then, 350 horse-power available for the production of revenue; but, owing to an idiosyncracy of electric power there is very much more. An instant's reflection will satisfy one that where an amount of power is distributed among a number of consumers for intermittent use the chance of every one's desiring to avail of his power at the same instant is infinitesimal, and experience, as far as it goes, confirms this. The character of the work done may also originate compensating influences to the same end, as when the power-circuit includes elevators which not only consume no power in their descent but even reinforce the main current with the counter-currents created by their own dynamos revolving under stress of their downward gravitation. It would be difficult to make too much of this characteristic, to which is largely due the wonderful economy inherent in this system of power distribution, and which is so prominent in the case of electric railways as to elicit the statement from the late Sir William Siemens that two trains on the same pair of rails, one ascending and the other descending a grade, influenced each other through the common current as absolutely as if connected by an actual rope.

It is this instantaneous adjustment throughout the entire circuit of the supply of, to the demand for, power that precludes waste or superfluity of it.

It is, therefore, considered perfectly prudent with an ordinary power plant to contract to deliver about double the total capacity of the generator.

In the problem under discussion, the quantity of marketable power was limited to 500 horse-power, which represents an annual rental of $60,000.

It thus appears that every one of the 2,642 ampères of current flowing in the conductor has a market value of $22.71 per annum.

On the other hand, the specified conductor—at the present depressed price of copper, say 15 cents per pound—would cost $22,248; the annual interest on which, at 6 per cent., would create an annual debit of $1,335.

Ohm's fundamental law of currents furnishes a useful point of reference at this juncture, viz.:

$$C = \frac{E}{R}$$

in which C = current in ampères,
R = resistance in ohms,
E = electro motive force, or potential, in volts.

As the latter factor is fixed at 120 volts, unity may be substituted for it in the formula, viz.:

$$C = \frac{1}{R}$$

which then signifies that the current varies as the reciprocal of—or inversely as the resistance. Colloquially, it reads: having the same electromotive force, to double the current, halve the resistance, and *vice versa*.

In conductors of similar material and equal length, the relative resistances would be inversely proportional to their cross-sections—*or to their weights*—and the final deduction is that currents of uniform potential moving in conductors of the same material and of equal length vary as the weight of the conductors.

A convenient unit of comparison is the annual market value of the ampère which, as has been shown, is $22.71. As the number of salable ampères in the case in point is a function of the weight of the conductor, the annual interest upon which *per pound* is $.009, viz.:

$$\frac{\$1335}{148{,}320} = .009,$$

it follows that it would require the annual interest upon 2,301 pounds of copper, viz.:

$$\frac{\$22.71}{.009} = .2523$$

to equal the annual value of one ampère.

Supposing the conductor to be reduced in weight by this amount and applying the rule deduced for this especial case—of the current varying as the weight—it appears that such a reduction would diminish the current some 108 ampères viz.:

$$148{,}320 : \frac{148{,}320}{2{,}523} :: 2{,}642 : 2{,}597$$

$$2{,}642 - 2{,}597 = 45$$

whose annual value is $1,022.

It thus becomes evident that the diminution of weight would entail vastly greater loss of revenue than the annual saving achieved thereby. Reducing the two opposing quantities to a common unit will give useful constants for the case under discussion, viz.:

Annual interest at 6 per cent. on 1 lb. copper = $.009.
Annual revenue from 1 lb. copper = $.40.
Weight of copper per ampère = 56 lbs.

From which it appears that until the price of copper rises forty-five times above its present figure, or the value of the ampère falls the same number of times below that assigned to it in the comparison, or a change occurs in both, producing a similar mutual relation, any reduction of weight in the conductor—all other factors remaining constant—would be a source of loss rather than of profit. Since it seems incontestably proven that for the stated case and specified conditions any diminution of the conductor would be prejudicial, it becomes of interest to know if the weight might be profitably increased.

It will be remembered to have been shown early in the discussion that the given current raised the temperature of the conductor 4.17° Fahr., which increased its resistance .86 of one per cent.

Since current varies inversely as resistance, viz.,

$$100.86 : 100 :: 2{,}642 : 2{,}619 + 2{,}642 - 2{,}619 = 23,$$

it appears that this trifling increment reduces the flow by 23 ampères whose annual value is $522.33. In the given conductor and under the prescribed conditions, each ampère requires 56 pounds of copper, and the addition of 1,288 pounds ($56 \times 23 = 1{,}288$), the interest on whose cost is but $11.59, would make good this very considerable annual loss. Increasing the conductor by this amount of copper would enlarge its cross-section from 3.25 to 3.30 square inches—a barely appreciable area.

It is evident that the method employed is only approximative, and may be continued to any desired degree of precision. There is no pretence of close accuracy, and it is even less than it might easily be, on account of ignoring fractional quantities and the ordinary small errors in the deduced factors made use of. The idea has been to rather suggest a method of dealing with such questions than to furnish absolute results. It seems to show that the formula published by Clark and Sabine is sufficiently exact for any case in ordinary practice.

The reasoning is rational rather than analytical, and probably could not be expressed by a mathematical abstraction. At all events, I am not sufficiently facile in the processes or symbolism to attempt it myself, and commend it to the attention of such as are.

Objections to Oil Lamps.

It has recently been argued that the present oil amps in use might be improved. The world is very slow about light, says an English review, though it wants light above everything. There is no reason why a Japanese or a Hindoo should not have invented a decent lamp three thousand years ago. There is no new principle in modern lamps and indeed no principle at all except the law of capillary attraction, which the Assyrian knew just as well as we do. It took the world hundreds of years to get rid of snuffers; and at this moment, with millions dependent on he trade, nobody will rid us of the grand drawback to the use of the mineral oils—their sickening and abominable stench. Purify the oil as you will—and some of the prepared oils look pure and limpid as water—and still whenever the housemaid is careless—and every housemaid is always careless about lamps—the oil gives forth its poisonous odor. Is it really beyond the reach of mechanical science to make a lamp which, by burning its own smoke or other device, literally cannot smell? We do not believe it, but, nevertheless, though a smokeless lamp would yield a fortune to the inventor, and though every house wants lamps, and though all men have a keen dislike of the smell of burning oil, the necessary improvement will not be made.

The Zipernowski-Deri System of Distribution by Secondary Generators.

In a recent issue we described the new forms of secondary generators constituting a part of the new system devised by Messrs. Zipernowski and Deri, and in response to numerous inquiries regarding further details of the system, we give to-day additional particulars in reference thereto. In this system the idea followed out has been to make each lamp entirely independent of all the others In order to accomplish this, all the primary coils of the secondary generators are coupled in parallel circuit, and the primary current generator is constructed for constant potential, so that even with a single secondary generator in circuit

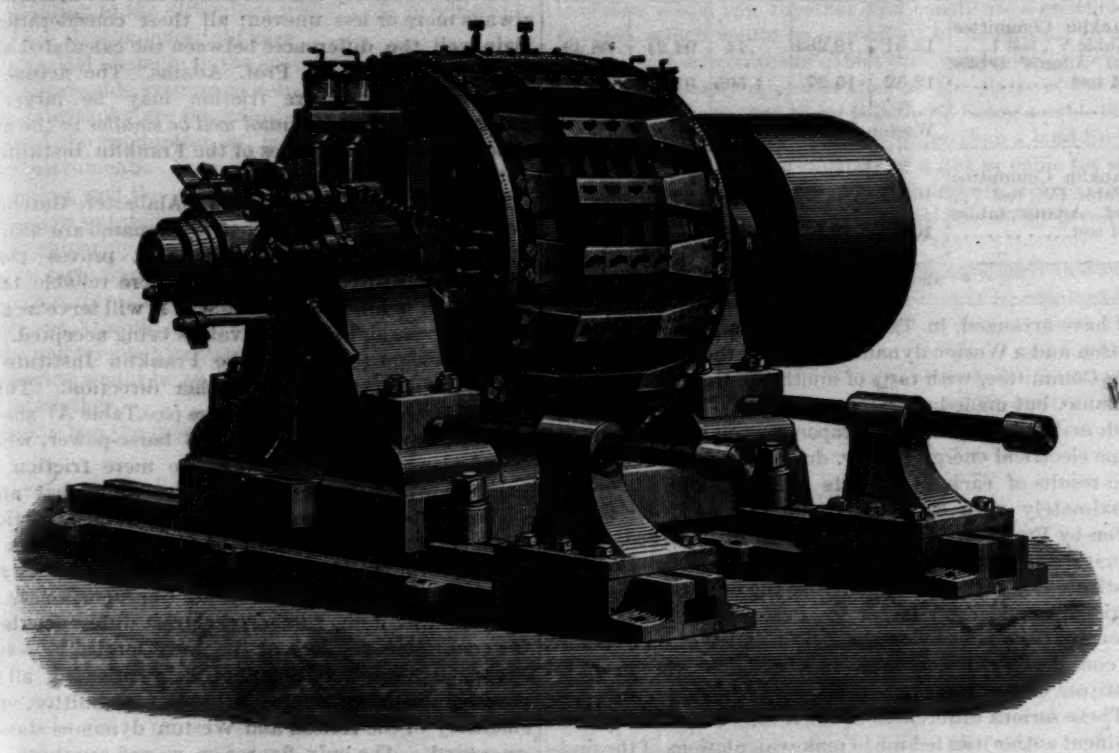


FIG. 1.—ZIPERNOWSKI-DERI PRIMARY MACHINE.

with only one lamp burning, the potential remains unchanged at the terminals of the primary.

Thus, while in the Gaulard and Gibbs system the *current* is kept constant under all circumstances, this system keeps the *potential* constant.

Our illustration, Fig. 1, shows the alternate current machine built by Messrs. Ganz & Co., and employed very successfully as the current generator.

In this machine the magnets revolve, while the coils in which the currents are generated are stationary. The

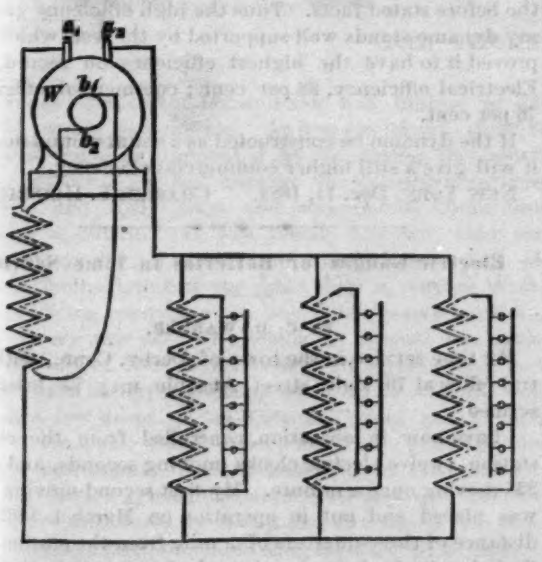


FIG. 2.—CIRCUIT WITH COMPENSATOR.

main current is led off from fixed terminals. The coils in which the current is induced, although containing some iron, are so constructed that the inductive action takes place, for the most part, directly upon the wires, and not indirectly through the magnetism generated in the iron cores, a principle similar to that employed in Siemens and Halske's alternate current machine. A part of the current is corrected or made continuous in a peculiar manner, and serves to energize the electrc-magnets. This commutation of a part of alternating current is effected without sparking at the instant when the current changes its direction. It is accomplished with safety by short-circuiting the whole system an instant before commutation takes place. The machine shown has eighteen magnet poles, and has a capacity of 60,000 volt-ampères.

The combination of an exciter for the electro-magnets with the alternating current machine itself is a decided improvement, doing away, as it does, with a separate exciting machine.

In order to keep the potential constant with varying work in the outer circuit, a very ingenious and simple plan has been adopted. While the primary coils of the secondary generators which feed the lamps are connected in parallel, a separate secondary generator called a "compensator" is placed in series in the circuit, and consequently is traversed by the main current. The current induced in the secondary of this latter is led to the commutator mentioned above, and after being corrected or made continuous, is added to the current which energizes the electro-magnets.

This is shown diagramatically in Fig. 2. Here the three lower secondary generators are shown connected in parallel to the main circuit, while the upper one, at the left, represents the compensator.

The primaries of the secondary generators are represented by full lines and the secondaries by dotted lines. *W* represents the alternating current machine, a_1 and a_2 being the main terminals; b_1 and b_2 are the brushes of the commutator, which corrects a part of the main current and that of the compensator.

If we suppose that a number of secondary generators be put in action, added to those already working in the circuit, the electromotive force at the terminals of the machine will sink, but the strength of the current will increase. But simultaneously with this increase of the main current in the primary of the compensator, an increase of current in the secondary of the latter takes place. This current then serves to increase the strength of the electro-magnets of the machine in a like proportion, and hence the E. M. F. remains unchanged. With a suitable proportioning of the compensator this regulation can be accomplished in the most complete manner, so that the system seems to possess all the requisites of a practical system of distribution.

Telegraph Wire Joints.

At the recent exhibition in honor of the members of the Telegraph Conference of Berlin, the Westphalian Wire Manufacturers' Association exhibited wires used at different times and in different countries. There were also shown the various joints employed, which we illustrate with the references beneath. As regards the joint representing America, we think it represents us very badly, and would consider it a very poor one. It may possibly be in use in some other country on this continent, but is certainly not employed among us.

TELEGRAPH WIRE JOINTS.

NOS. 1 AND 13. FRANCE. NO. 2. BRITTANIA JOINT. NO. 4. AMERICA. NO. 3. CONNECTION WITHIN SHEATH OF NO. 4. NOS. 5 AND 7. PRUSSIA. NO. 6. SECTION OF NO. 7. NO. 8. HANOVER AND HOLLAND. NO. 9. ENGLAND AND BELGIUM. NO. 10. SIEMENS JOINT. NO. 12. SAXONY. NO. 11. SECTION OF NO. 12.

Points on Bichromate of Potash.

Bichromate of potash comes from two sources, Scotland and Baltimore. The foreign manufacturers have made and broken several combinations, says the Boston *Commercial Bulletin*, but seem fairly disposed to stick to the present one. In this market the price of American bichromate is made to conform to that of foreign.

Much dissatisfaction has existed of late with the manner in which bichromate has been sold. There has been no uniformity of price, and cases are frequent where goods have been sold at less than cost for the sake of keeping the trade from a rival.

At a recent meeting of the Drysalter's Club, a plan was conceived which has since been matured to obviate this difficulty.

Dealers and manufacturers have agreed to adhere to manufacturers' prices on five-cask lots, at present 9½c., and to add to this ¼c. for three casks and ¼c. for one cask. All these prices are ex store. These prices are agreed upon not only by the Boston trade but by all New England dealers, that no manufacturing centre may be given an undue advantage.

Steel for Magnets.

As the result of a long series of experiments made under the auspices of the United States Geological Survey by Mr. Carl Barus and Vincent Stronhal, the record of which is submitted in Bulletin No. 14, these gentlemen reach the following rules for the construction of permanent magnets: 1. Rods tempered glass-hard are not to be used as essential parts of magnetic instruments. 2. Having tempered a given rod in such a way as insures uniformity of glass-hardness throughout its length, expose it for a long time, say 20 to 30 hours, to the annealing effect of steam at 100° C. The operation may be interrupted as often as desirable. The magnet will then exhibit the maximum of permanent hardness for 100° C. 3. Magnetize the rod —whether originally a magnet or not is quite immaterial —to saturation, and then expose it again for about five hours (in case of massive magnets even larger intervals of exposure are preferable) to the annealing effect of steam. The operation may be interrupted as often as desirable. The magnet will then exhibit both the maximum of permanent magnetization as well as the maximum of permanent hardness corresponding to 100°. Its degree of magnetic retentiveness against the effects of temperature, time and percussion is probably the highest conveniently attainable. If we assume that we have a series of iron carbides, ranging from pure iron up to cast iron, with 6 per cent. carbon, other ingredients remaining unaltered, we will have at a certain range the product known as steel. On comparing the effects of slow and sudden cooling on such a series, by means of the determination of the thermo-electric hardness and of the specific resistance of the individual members in both states of hardness, we will find, on plotting the curves with carbon per cent. as abscissa, and thermo-electric hardness or specific resistance as ordinate, that in both cases there is an increase of these qualities with increase of carbon. The manner of increase, however, is different. Starting with pure iron where the curves of sudden and slow cooling are coincident, and constructing the curve of sudden cooling, we find that it is concave toward the axis of abscissas, and on constructing the curve of slow cooling, we find that it is convex. These curves will again intersect at some point near 5 or 6 per cent. carbon. If now a fresh curve be constructed, using as ordinates the differences between the logarithms of the pairs of values of thermo-electric hardness, it passes through a very sharp maximum in the region of 1.5 per cent. carbon; if instead of thermo-electric hardness we take specific resistance, a similar maximum is found, about 2 per cent. carbon. The authors propose that this maximum state be taken as defining the normal steel. It is now easy, by determining the maximum and

minimum values of thermo-electric hardness of any member of the series, to classify it according to its carbon percentage, other things remaining the same.

The Competitive Tests of the Edison and Weston Dynamo Electric Machines.

To the Editor of The Electrical World:

Having carefully gone over the report of the special committee of the Franklin Institute and their tables of tests, and compared the same with other tests on record, I note that the data of the horse-power absorbed by the friction of the armature varies considerably from the results obtained by other authorities. I regret that several data required to check more fully the results published are not given; thus the weights of the armatures and the pressure of the brushes upon the commutators are omitted, from which, with the number of revolutions, one could well calculate the H. P. absorbed by the friction of the armature, which, if found correct, would credit the value of the total H. P. as given.

There can be no doubt that armatures of the same makers, having approximately the same weight and number of revolutions, will absorb approximately the same H. P. in friction when running without load; thus, when comparing similar tests with each other, they ought to show similar results. The items of armature friction and total H. P. absorbed, if taken too small, will show an enhanced efficiency of the dynamo, and discredit the total H. P. measured.

Careful tests have been made in London, in 1882, during the International Electrical Exhibition, by the appointed committee, having Prof. W. Grylls Adams, F. R. S., as chairman. The particulars and tables of tests were given by Professor Adams in his inaugural address before the Society of Telegraph Engineers and Electricians, on Jan. 10, 1884. I shall refer to these tests, and also to the exhaustive tests of my own dynamo, made by Messrs. Alabaster, Gatehouse & Co., consulting electrical engineers, in London, March, 1884. The particulars of these tests were given in *Engineering*, and are also contained in Dredge's "Electric Illumination," Vol. II.

I have extracted from the above named tests several data, and arranged the same with corresponding data from the Franklin Institute committee report in the two following tables:

TABLE A.

	Edison Dynamos.		Weston Dynamos.			
	Franklin Committee.		Prof. Adams' tables of tests.	Franklin Committee.—Table III., test 1.	Prof. Adams' tables of tests.	Heinrich's Dynamo. A. G. & Co. Tables, test 5.
	Table VI., test 5.	Table II., test 1.				
Electrical energy in horse-power	68.25	35.67	12.52	28.47	10.65	7.53
Probable weight of armatures in pounds	800	500	200	400	200	50
Number of revolutions of armature	1092	1208	1096	1043	.....	1680
Horse-power absorbed by friction of armature	.393	.437	1.565	.3115	1.337	.51

This table contains the extracted data of six tests made of six different machines by the authorities named. The quoted electrical energy in H. P., serves to indicate the size of the machines, and from the (probable) weight of the armatures, with the number of revolutions, one can roughly form an estimate of the H. P. absorbed by the friction of the armature. The other extracted figures show that the H. P. absorbed by the armature friction of the Edison and Weston machines, tested by the Franklin committee, amounts only to a fraction of a H. P., while the H. P. absorbed by the armature friction of machine of the same makers, but measured by Prof. Adams, is from four to five times larger, notwithstanding the latter machines are only one-fifth to one-third the capacity of the former.

Observing these facts, one cannot help asking: Which are the true or most probable figures? In answer I will point out the fact that in Prof. Adams' tests, all H. P. measurements were checked with an absorption dynamometer. Practice has shown that under varying conditions all transmission dynamometers are unreliable, and no calculations ought to be made from their indications, but the indications should be observed and afterwards reproduced by applying an absorption dynamometer, from which the power absorbed can be got very exactly in foot-pounds. Further, during the exhaustive tests of my dynamo it appeared that the armature weighing 50 pounds, with 1,680 revolutions, absorbed .51 H. P. Now, the Franklin Institute Committee has actually measured less power as being absorbed by an Edison armature (Table VI., test 5), weighing probably sixteen times as much as my armature. (See Machines 1 and 6 in Table *A*.)

All other measurements made by Prof. Adams of the other armatures, viz., the Brush, Gramme, Burgin, etc., agree well and are proportionate, which cannot be said of the Franklin Institute Committee measurements. In fact, the H. P. absorbed by the friction of an Edison armature giving out an electrical energy of 68 H. P. has been put down as .393 H. P., while the H. P. absorbed by the friction of another Edison armature, of half the capacity, has been given as .437 H. P. (See Machines 1 and 2 of Table *A*.)

TABLE B.

Tested by whom.	Electrical energy in H. P.	Total H. P. absorbed by dynamo	H. P. absorbed by friction of armature	Electrical efficiency	Commercial efficiency
Edison Dynamos.					
Franklin Committee Table V., test 1	12.51	13.284	.14	94.21	88.42
Prof. Adams' tables of test	12.52	15.27	1.565	91	74*
Weston Dynamos.					
Franklin Committee Table IV., test 7	10.40	10.774	.167	96.53	90.10
Prof. Adams' tables of test	10.65	13.83	1.337	85	61*

*Calculated by the writer.

I have arranged, in Table B, extracts from tests of an Edison and a Weston dynamo, made by the Franklin Institute Committee, with tests of another Edison and Weston dynamo, but made by Professor Adams. The dynamos of each maker are of the same capacity, and gave almost the same electrical energy in H. P. during the tests. Thus the two results of each set of tests ought to correspond approximately with each other, but, as seen, the figures given by Professor Adams of the H. P. absorbed by the armature friction is eleven times larger than the Franklin Institute Committee's results. Also the total H. P. absorbed is given considerably larger by Professor Adams; consequently, the efficiency of the Edison and Weston dynamos is considerably lower than that given by the Franklin Institute Committee.

These serious differences in the results obtained by such eminent authorities led me to make calculations of the probable H. P. absorbed by the friction of the armature of the six machines of Table A. To do this I required to know the weight of the armatures, the pressure of the brushes upon the commutators, which are not given in the report. I had thus to find these data, and I got them on comparing my machine with the others. The weight of my armature is 50 pounds, which is one-tenth the total weight of the machine. I use the least copper (only 16½ pounds for an electrical energy of 7.53 H. P.); thus the probable weights of the other armatures, as given by me, are most likely smaller than in practice. Further, the pressure with which both of my brushes are held to the commutator I found to amount to 7 pounds for a current of 23 amperes; thus the probable brush pressure I accepted for the other and larger machines, giving a larger current up to 400 amperes, will also be found to be less than actually used.

The results of my calculations are given in Table C.

TABLE C.

	Edison Dynamos.			Weston Dynamos.		Heinrich's Dynamos, A., G. & Co. Tables, test 5
	Franklin Institute Committee		Prof. Adams' tables of tests	Franklin Committee, Table III., test 1	Prof. Adams' tables of tests	
	Table VI., test 5	Table II., test 1				
Diameter of bearings in inches	2⅝	2⅜	1⅛	1⅜	1½	1⅛
Probable diameter of commutator in inches	5	4	4	4	4	3
Probable pressure of brushes upon commutator in pounds	12	10	8	10	8	7
H. P. absorbed by friction of bearings	.98	.67	.14	.3199	.14	.038
H. P. absorbed by friction of brushes	.559	.38	.27	.3347	.275	.383
Total H. P. absorbed by friction of arm.	1.539	.99	.41	.6546	.415	.32

I used the following formulæ:

1. H. P. absorbed by friction of bearing in journals:

$$\frac{\mu\ w\ (\pi\ d)\ n}{33{,}000} = \text{H. P.}$$

μ. coefficient of friction = .054.
w. weight of armature in pounds.
d. diameter of bearings in feet.
n. number of revolutions per minute.

2. H. P. absorbed by friction of brushes upon commutator:

$$\frac{\pi\ d\ w\ n}{33{,}000} = \text{H. P.}$$

d. diameter of commutator in feet.
w. pressure of brushes upon commutator in pounds.
n. number of revolutions per minute.

Comparing the calculated results with the measured results of Table A, it becomes evident that the H. P. absorbed by the friction of the armature, measured by the Franklin Institute Committee, is given too low, while Prof. Adams' results are larger than the calculated. The latter fact can well be explained, viz., that the data upon which I found my calculations are taken too small; on the other hand, my calculations would only show what results could be obtained, under the most favorable conditions of the frictional surfaces, such as in practice we do not always have. New machines will have greater friction, and the coefficient becomes much larger.

Further, in my calculations no account has been taken of the resistance of the air, which is considerable if the armature is slightly uneven, and in fact the armatures are always more or less uneven; all these considerations explain well the differences between the calculated and the measured results of Prof. Adams. The actual H. P. absorbed by armature friction may be larger than the calculated; *but it cannot well be smaller* to the amount appearing from the figures of the Franklin Institute Committee.

The results obtained by Messrs. Alabaster, Gatehouse & Co. of the armature friction of my dynamo are also larger than my calculations show, which proves that the correctly measured H. P. would be more reliable than the calculated, while the calculated H. P. will serve as a check against errors and too small values being accepted.

The horse-power tests of the Franklin Institute Committee are altogether in the other direction. Thus the tests of the large Edison machine (see Table A) show the total armature friction to be .393 horse-power, while my calculations in Table C show the mere friction of the bearings to amount to nearly three times that amount.

These differences cannot well be explained, particularly when comparing the weight of that large Edison armature with the weight of my small armature, which absorbs .51 horse-power. Adding the other unproportionate figures given in this item, further, the great differences between the committee results and the most probable results of Professor Adams, one cannot help rejecting all horse-power measurements made by the committee, and the efficiency of the Edison and Weston dynamos stands unsupported. The only figures on record are those of Professor Adams:

	Efficiency.	
	Electrical.	Commercial.*
Edison	91	74
Weston	85	61

*Calculated by the writer.

In the tests of my dynamo the H. P. absorbed *for producing the electrical energy* was calculated from Prony brake readings (see description of tests), which were taken under conditions excluding any doubt as to the results obtained being correct. The H. P. absorbed by the armature friction agrees well with Prof. Adams' tests and all the before stated facts. Thus the high efficiency given to my dynamo stands well supported by the tests which have proved it to have the highest efficiency on record, viz.: Electrical efficiency, 98 per cent.; commercial efficiency, 76 per cent.

If the dynamo be constructed as a shunt wound machine it will give a still higher commercial efficiency.

NEW YORK, Dec. 11, 1884. CHARLES F. HEINRICHS.

Electric Gauges for Batteries in Time Service.

BY C. D. WARNER.

My time service in the town of Derby, Conn., with central office at 76 Main street, Ansonia, may be briefly described.

I have now in operation, controlled from the central station, twelve electric clocks moving seconds, and about 225 moving once a minute. My first second-moving clock was placed and put in operation on March 1, 1882, at a distance of three-quarters of a mile from the station. My first circuit of minute-moving clocks was set in operation on Oct. 1, 1883, and consisted of about ten clocks. From that date I have had a continual demand for the clocks, with several applications yet unfilled. I have only had one subscriber discontinue the use of the electric time. I have made eight other removals during this time, for such causes as change of proprietors of stores, vacant stores, failures of parties using, etc.

I had not been long in the business before I experienced the usual difficulty with the fluctuating current of my batteries, which often ran so low as to stop some of the clocks before it was noticeable, and then perhaps double the strength necessary. One poor cell would give a great deal of trouble before I knew of its condition.

This showed the necessity of a gauge that could be inserted in the circuit in series with the clocks that would have only the same resistance as an electric clock, and after experimenting with a number of forms, I adopted the one described in your pages some time ago, and that is now shown in your advertising columns. With this in a circuit of clocks that were first adjusted to run at a certain number on the gauge, I am enabled to know at all times the condition of my batteries.

If the current runs low, I go to my battery room with my small pocket-size gauge and touch its terminals to each

cell and pick out the poor cells, and I replace them with good ones without interruption of the service to my subscribers.

My circuits soon became so numerous as to require some systematic arrangement of them, which brought out the invention of my central station system. The population of our town is about 12,000.

The Condenser in Telegraphy.*

BY BENJAMIN THOMPSON.

Having been requested to entertain you this evening, I shall endeavor to do so by explaining the uses of the condenser in telegraphy, including an improvement of my own relative to the manner of using it. I shall first direct your attention to the difficulties which exist in telegraphy and which the condenser obviates.

The greatest obstacle to the successful and rapid operation of telegraphic systems is induction. Its injurious effects in telegraphy are the retardation of the electric impulses and the production of false signals upon the receiving instruments. Such retardation limits the speed of transmission, and the production of false signals renders the messages unintelligible. Retardation is most troublesome in submarine and subterranean cables and long land lines. In fact, were it not for this difficulty a greater number of words could be transmitted, in a given time, through one Atlantic cable than can now be sent over twelve, and telephonic communication between Europe and America would be as practicable as from one part of a city to another.

In 1858, when the first Atlantic cable was laid, it was found that the speed of transmission was limited to one or two words per minute. At first electricians thought the speed might be augmented by increasing the power of the battery. The last message to Valencia was "two hundred and forty trays and seventy-two liquid Daniells now in circuit." It was found, however, that this large battery did not increase the speed, but, in fact, destroyed the insulation of the cable, only a portion of the message being received when the cable ceased working. The battery now used with which to operate the cables consists only of four or six cells, and signals have been made with a battery consisting of a silver thimble containing a few drops of an exciting liquid and a small piece of zinc, and with a battery made of a gun-cap. Receiving instruments, more sensitive than those used in 1858, the duplex system (by which two messages traverse the cable simultaneously in opposite directions), and other improvements have increased the capacity of a cable to about twenty words per minute—a rate, however, very much below that attained on land lines.

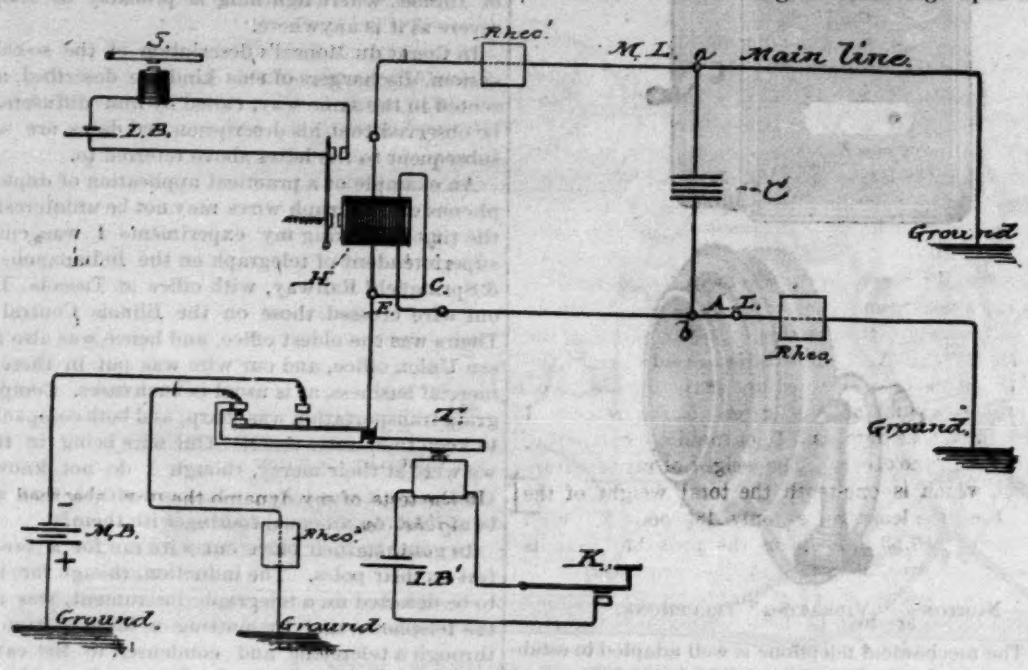
The peculiar noise heard in the telephone, interfering so seriously with its operation, is the result of induction from neighboring telegraph wires. Owing to the same cause, conversation on parallel telephone wires is often audible. In the case of the telephone, however, we can distinguish the voice of the person we are conversing with, because of its being generally louder than the "induced" conversation; but in telegraphy the impulses, passing over lines in close proximity, produce a rattling of the "sounder," which prevents the message from being received.

The sensitive receiving instruments employed in the modern systems of telegraphy are most seriously interfered with by induction, those used on single-message Morse circuits being but slightly affected. The currents used to operate the modern systems also produce more marked inductive effects on parallel wires than those employed on Morse circuits, as the electromotive force required to operate them is of a much higher potential.

In 1873, shortly after the introduction of the duplex system, it was found that, owing to the trouble arising from induction between parallel wires, only about one-quarter of the wires on a pole line could be utilized as duplex circuits, and, later, when the quadruplex system (by which four messages traverse a wire simultaneously) and the Wheatstone automatic system (by which messages are transmitted automatically), instead of by the hand of an operator came into use, the same difficulty was experienced. Hence, it has been impossible to utilize these valuable systems, except to a limited extent.

Retardation is due to inductive action between the conductor and the earth. Every telegraph line is substantially a condenser or Leyden jar, the conducting wire conforming to the inner coating, the air to the glass, and the earth to the outer coating of the jar. Consequently, a sensible time is required to charge and discharge the line. If the necessary time to discharge were not allowed, the impulses would run together and constitute a continuous current, which would be equivalent to no effect. In submarine and subterranean cables the condenser or Leyden jar is more nearly approximated, as the plates of the condenser, as it were, are closer together; hence a cable takes a greater time to charge and discharge than a land line of the same length. This capacity of a line or cable for storing electricity is called its static charge (or storage) capacity, and the discharge of the stored electricity is termed the static discharge.

Previous to the application of the condenser in duplex telegraphy, the duplex system could only be employed on short circuits, for the reason that on long circuits false signals were produced during the charging and discharging of the line. This difficulty was overcome by employing the condenser in such a manner as to neutralize the effects of the static charge and discharge upon the receiving instruments. I will now explain how the condenser accomplishes this result.



THE THOMPSON DUPLEX.

[Mr. Thompson then by the aid of the black-board showed the method of applying the condenser as devised by Stearns.]

This important application of the condenser was made by Mr. Joseph B. Stearns, of Boston, Mass., in 1872. Without it, the duplex, quadruplex, and automatic systems would have been of little utility.

The adoption of these systems by the Western Union Telegraph Company had, on the 31st day of December, 1884, saved that company the cost of the construction and maintenance of 164,671 miles of line, or, in money, about $20,000,000.

I will now describe my method of employing the condenser, by which not only are the false signals due to static charge and discharge prevented, but by which the effect of induction from parallel wires is obviated and the retardation trouble greatly reduced.

I connect (see diagram) the condenser between the main and artificial lines at points of different potential, the point of connection to the artificial line being greater than that to the main line, and employ a small resistance in the main line for the purpose of producing the necessary difference of potential.

When the battery is placed to line, the static charge divides and passes in opposite directions through the coils of the relay, part going through the main line coil conductively and part passing through the artificial line coil to the artificial line side of the condenser and inductively through the condenser to the line.

Hence the effect of the static charge on the relay is neutralized.

When the battery is withdrawn and the line put to earth, the static discharge is met by the discharge of the condenser and partly neutralized, the balance of the discharge being divided between the coils of the relay. Hence the effect of the static discharge on the relay is neutralized.

Assuming the force of the battery to be 100 plus in charging the line, the discharge through the condenser would be 100 plus, so that for the moment the force on the line would be 200 plus.

In a duplex system in which reversals of battery are used, assuming the battery to be 100 cells and the plus pole to line, the charge of the condenser would be minus on the main line side and plus on the artificial line side.

When the battery is reversed, there would be three effects upon the line operating in conjunction and in the same direction—that is, a portion of the charge of the condenser of 100 minus, the inductive charge through the condenser of 100 minus, and the battery charge of 100 minus, which would be a temporary effect of 300 minus on the line; and every reversal would produce the same effect. Hence the potential of the battery employed may be greatly reduced, as the time necessary to charge and discharge the line, owing to this inductive effect of the condenser, is reduced about seventy-five per cent.

Induction from parallel wires divides between the two coils of the relay, a part passing through the main line coil conductively and part passing inductively through the condenser and conductively through the other coil. As these currents pass in opposite directions around the core of the relay, the effect of the induction is neutralized, and false signals prevented.

My invention is applicable to electric circuits generally, where it is desirable to obviate the difficulties I have mentioned. Its important feature commercially is that it enormously increases the capacity of telegraph lines for doing business, by enabling every wire upon a pole line to be operated, as may be desired, by the duplex, quadruplex, or automatic systsm. In this respect, the increase of capacity is far beyond that which these inventions have accomplished. The trouble arising from retardation being reduced about seventy-five per, cent., the speed of transmission, in the automatic system may also be greatly increased, and an Atlantic cable of 2,000 knots may be operated almost as rapidly as a cable of 500 knots; or, in other words, each of the Atlantic cables, now laid, instead of having a capacity limited to twenty words a minute, may be operated so as to transmit sixty words a minute. This increase in speed (practically making one cable equal to three) would enhance the value of a cable threefold.

The value of the invention in connection with land wires may be illustrated by making a comparison of a single pole line—say from New York to Chicago—carrying twelve wires, and operated by the various systems, with and without my invention. By using the twelve wires, as ordinary Morse single-message circuits, the capacity of the pole line would be 360 words a minute—assuming each of the twelve operators to average thirty words. The number of words, per minute, which could be transmitted on such a pole line, and the number of wires to which the twelve are made equivalent by the modern systems (in comparison with the single-message system), may be thus stated:

As at present operated (using three of the twelve wires for the modern systems), the duplex system would make the capacity of the pole line 450 words per minute, or practically, create three extra wires, making the twelve wires equal to fifteen, the quadruplex would make the capacity 630 words per minute, or create nine extra wires, making the twelve equal to twenty-one, and the automatic (assuming the speed to be 150 words per minute) would make the capacity 720 words per minute, or create twelve extra wires, making the twelve equal to twenty-four.

By employing the condenser in accordance with my method, and using all of the wires for the modern systems, the duplex would make the capacity of the pole line 720 words per minute, or practically create 12 extra wires, making the 12 equal to 24; the quadruplex would make the capacity 1,440 words per minute, or practically create 36 extra wires, making the 12 wires equal to 48; and the automatic (assuming the speed to be 300 words per minute) would make the capacity 3,600 words per minute, or create 108 extra wires, making the 12 wires equal to 120. In connection with the automatic system, the pole line would equal in business capacity five such pole lines as at present operated.

When we consider the number of such pole lines that exist in this country, and that one between the points mentioned costs about $800,000 (without considering right of way), the value of the condenser in connection with telegraphy becomes apparent.

American Cable Stock and the Stock Exchange.

The American Cable Company's stock, representing a par value of $14,000,000, has been struck from the list of the Stock Exchange, and no more dealings in it will be permitted until the cable company recedes from what the Exchange declares to be an unfair and discreditable position. Before Scoville, the confidential clerk of I. Henry Day, fled, he marketed many of Mr. Day's securities and put the proceeds into his own pocket. Among these securities were 700 shares of American Cable stock, which, in blocks of 100 shares each, passed into the hands of clients of leading brokerage houses. The firm of Work, Strong & Co. bought 100 shares, and taking it to the office of the company had the stock transferred to the name of one of their customers. Other firms had similar transfers made of the stock which they bought. The company not only issued new certificates in lieu of the old ones, which they canceled or destroyed, but

* Read before the New York Electrical Society, Dec. 9, 1885.

they paid two or three regular quarterly dividends to the new holders, who heard no question as to their title to the stock in their names until suddenly, some months ago, the Western Union Telegraph Company, guarantors of the cable dividends, served notice that the certificates outstanding, issued in lieu of the old Day certificates, were invalid and valueless, inasmuch as they had been issued in exchange for certificates stolen and fraudulently marketed. As a transfer agent, the company said, its duties were purely of a clerical character, and that it assumed no responsibility and gave no guarantee in issuing new certificates. The party holding an invalid certificate must look for a remedy to the party from whom he had purchased.

Against this view the Stock Exchange contends that a transfer agent is not a mere clerk without responsibility. Its work means something. It must surround that work with safeguards; the investing public is obliged to depend upon it, and certificates issued regularly by the authorized transfer agent of any corporation must stand as the best evidence of ownership. The transfer agent ought not to suffer from imposition, for its investigations before issuing certificates should be made so thorough as to render imposition absolutely impossible. And, declare the Exchange's Governors, this view must be adopted by corporations who seek any recognition from the Exchange. Thirty days ago notice to this effect was served on the American Cable Company. The questions at issue and likely to grow out of this case will probably lead to many complicated lawsuits.

Secondary Battery Plates.

Many experimenters and amateurs working in the field of electric storage batteries will no doubt be thankful for a hint as to the method to pursue to produce an accumulator. Mr. A. V. Meserole, of this city, has recently sent us for examination one of his prepared lead plates, suitable for such batteries. It is perforated and coated with an adhesive deposit of lead oxide.

If it is desired to make small batteries, the plates can be cut to any size required. The sheets are then soldered to a conducting strip of thick sheet lead, first scraping a clean spot on the plate to solder to. The lead conducting strip serves to hold the plates to a wood or hard rubber cover made to fit a glass or rubber battery cell. The lead conductor can be brought up through the cover, and a screw-post soldered to it on top. Two or more plates mounted this way complete the storage cell. A solution of one part of sulphuric acid to nine parts of water is put in the battery cell. A charging current is then run through for several hours, which will convert the plates into a positive and negative condition. A current of four or more volts tension from a constant battery is required for one cell. The storage cell should be always charged in one direction and the poles marked. The cell will improve by repeated charging from a high current. The prepared plates can be cut and mounted similar to those of a zinc and carbon cell, taking the precaution to solder all connections.

When the storage cell is fully charged, the positive plate will turn to a dark brown, almost black, and the negative plate to a light gray or lead color. This is a good indication that the cell is properly charged.

The Law on Delivery of Telegrams.

Another decision on delay of telegrams has been rendered in Illinois. McDaniel sent a message to Mrs. La Fountain, Kankakee, which was not delivered properly, as the sender claimed, and he sued for the statutory penalty. On the trial it was shown that the sender, when asked for the given name of Mrs. La Fountain, replied that it was not necessary, for she was well known. The company set this up as contributory negligence, and averred that they had made due delivery. The plaintiff recovered judgment and the company carried the case—Western Union Telegraph Co. *vs.* McDaniel—to the Supreme Court of Indiana, where it was reversed. Judge Elliott in the opinion said: "1. When it is shown that a telegram has not been properly delivered it falls upon the company to explain the cause of the failure to deliver. 2. It is contributory negligence on the part of the sender of a telegraphic message not to give the first name of the party addressed and the residence, where it is demanded, unless the person is well and definitely known. In this case the person was not well known, and the town to which it was directed had 12,000 inhabitants. Clearly the plaintiff was at fault, and he cannot recover."

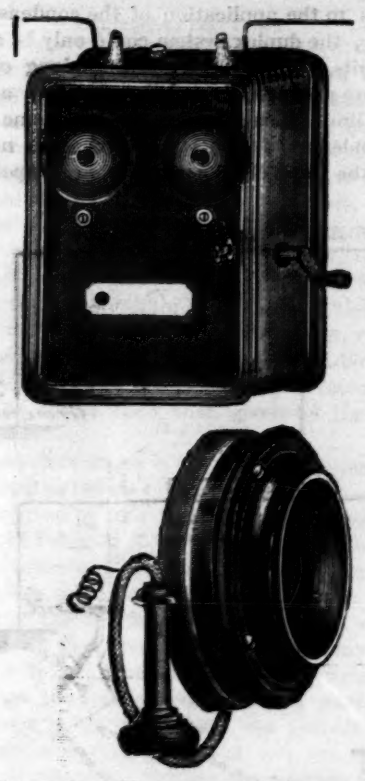
A Pittsburgh Man's Underground System.

Mr. T. D. Williams, manager of the Western Union Telegraph Company in Pittsburgh, has been granted a patent on an underground conduit for electric wires, which promises to be a success. The conduit can be built of any size desired. Every one-fourth of a mile there is to be a man-hole. Within the one conduit is a smaller one, resting on the bottom of the other, in which the wires are to be run. An endless wire running on two wheels, one wire within the smaller conduit and the other one on top, is used to draw the wires through one section to another. There is no conflict between the electric wires. The placing of wires within is made easy by this arrangement. The inner conduit is punctured in order to allow any moisture to pass out. There are vent pipes from the conduit to lead into sewers or out into drainage. In constructing the conduit, it can be completed, if desired, before the wires are put in. Where a leak occurs along any of the line wires, it may be located by passing from man-hole to man-hole until found. The wire is then cut at one of the two man-holes between which the leak occurs, and drawn to the other man-hole. It is there repaired, or a new section joined on, drawn back to the first man-hole and connected up.

"My object," said Mr. Williams, to a reporter of the Pittsburgh *Chronicle-Telegraph*, "is to construct a conduit for telegraph and other wires, which shall be dry, and provided with means for conducting condensed moisture away from the wires and out of the conduit; means for laying or taking up wires and examining any particular wire without excavating the earth under which the conduit is laid, and without interfering with other wires, and means whereby the tapping of the conduit at any point and making local connections with any particular wire is facilitated."

A Mechanical Telephone.

Our illustration represents an acoustic telephone and magneto-call adapted for working within a limit of two



NORTON'S "VIBRATING" TELEPHONE.

miles. The mechanical telephone is well adapted to establish communication between parties located within short distances of each other, and where the expense of an electric telephone would be prohibitive. The present instrument is made by Mr. W. L. Norton, of Buffalo, N. Y., and, it is claimed, removes the objection generally raised against mechanical telephones.

Condensers in Telephony.

BY D. H. F.

I wish to acknowledge the courtesy of Mr. Lockwood in his recent letter on the above subject, and I would not offer

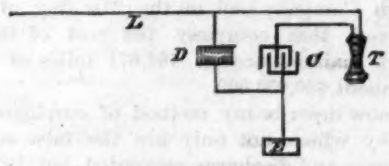


DIAGRAM OF CIRCUIT.

more were it not for the fact that a few oversights on his part may lead to wrong conclusions. In my former communication, it was not my intention to claim to be the first to transmit telephonic *signals* through condensers, but to claim a *system* or method of transmitting through them which had been credited to others.

I had duplexed telephones on telegraph wires by means of branch wires and condensers, as described by Mr. L., before I knew it had been done by others, and filed a caveat for the same; but of course abandoned it when I heard that Messrs. Block & Roseburgh were entitled to priority. I had a copy of their patent when I filed the application for mine.

Theirs chiefly refers to a method of utilizing telegraph lines for telephone service, without interfering with telegraph service.

They do not show or describe a battery, microphone, transmitter or any method of transmitting, unless the "earphone" is used as a transmitter, and the fact that they repeatedly use the words "with or without secondary-current apparatus" may be taken as evidence that they regarded the method or means of transmitting as a separate matter.

Between theirs and mine there is no similarity in the arrangement, or in the objects aimed at, except that both use condensers. The same is true of Gray's harmonic duplex, referred to by Mr. Lockwood. These patents are dated Feb. 18, 1879.

A condenser interposed between any aërial line and the earth, as described by Mr. L., would indeed "prove to be a first-class lightning trap," unless some efficient arrester was used in connection with it. In the letter of March 20, 1879, to the National Bell Telephone Company, referred to in my former communication, such an arrester was diagrammed and described, from which I copy and quote: "*L*, represents the line; *T*, telephone; *C*, condenser; *D*, *brush* condenser and discharger; *E*, the earth. (*See Diagram.*)

"As thus arranged, and without the *brush* condenser and discharger *D*, the charge upon the line would not be constant, and in some conditions of the atmosphere, or during storms, would rise to a tension which would burst through the condenser. To prevent this I attach the *brush* condenser and discharger *D* to the wire between the telephone and the line. The discharger is composed of two surfaces of fine wires in the form of brushes or of sharp points placed opposite to and near each other, the two opposing surfaces serving as the plates of a condenser and the air between as the di-electric. Owing to the facility with which electricity is discharged from sharp points, they cannot hold a charge. With this discharger, the telephone can be safely worked during severe lightning storms."

Those which I used in my experiments were composed of bundles of sewing needles, and with these I used condensers for months without injury, in the prairie section of Illinois, where lightning is probably as frequent and severe as it is anywhere.

In Count du Moncel's description of the so-called Herz system, dischargers of this kind are described, and represented in the same way, called by him diffusers. It will be observed that his description and dates are some years subsequent to the letter above referred to.

An example of a practical application of duplexing telephones on telegraph wires may not be uninteresting. At the time of making my experiments I was employed as superintendent of telegraph on the Indianapolis, Decatur & Springfield Railway, with office at Tuscola, Ill., where our wire crossed those on the Illinois Central Railway. Theirs was the oldest office, and hence was also the Western Union office, and our wire was put in there for commercial business, as is usual in such cases. Competition for grain transportation was sharp, and both companies desired to keep their rates secret. Our wire being in their office we were at their mercy, though I do not know that advantage of it was taken. It was desirable that we should be at least on an equal footing with them.

In going to their office our wire ran for a few hundred feet on their poles. The induction, though far too feeble to be detected on a telegraph instrument, was ample for the telephone, and by putting a branch from our wire through a telephone and condenser to the earth in the manner described by Mr. Lockwood, I could easily read the messages passing over their wires, and the arrangement did not in the least interfere with the working of ours. When keys were worked on our line within a few miles, the telephone would snap violently, but when twenty or more miles away the signals lost much of their sharpness, and did not interfere seriously with our eavesdropping. I flattered myself that I had out-generaled Mr. Jones, but I fear that such was not the case. After a while it was not uncommon for our wire to get open in their office for a few minutes at a time. I am inclined to think he flanked me, and took this means to make my arrangement a failure while messages relating to rates were being sent on his wires.

An Execution for Unpaid Western Union Taxes.

An execution was placed in the hands of Sheriff Davidson on Thursday the 10th inst., against the Western Union Telegraph Company, issued by Controller Chapin to satisfy the judgment obtained by the State against the corporation in April last. The judgment is for the franchise tax of 1881, levied under the law of 1880, and was originally for $170,000, with interest, the amount unsatisfied now being about $130,000. Dr. Norvin Green, President of the Western Union Company, when asked if the company intended to satisfy the execution said:

"The matter has been placed in the hands of counsel, and I don't know myself yet just what we shall do. Of course, if we find that we are obliged to pay the money, we shall draw a check for it, but it will be very unjust to compel this, and I have no doubt if it is done that the Legislature will pass a relief bill returning us the amount.

"The law of 1880, under which the judgment was secured, authorized the Controller to levy a tax on the capital stock of all corporations doing business in the State, the amount of taxation being measured by the dividends declared on the stock. In 1881, this company made a stock distribution, capitalizing its surplus earnings to the old stockholders before taking in the Mutual Union and the Atlantic & Pacific. The Controller assumed to regard this as a dividend, and wanted us to pay taxes upon it. We went to the court on the question, claiming, first, that the stock distribution was not a dividend, but was a mere capitalization of dividends that had been accumulating for fifteen years; and, second, that

it was unjust to tax the Western Union on a capital stock representing property in thirty-eight States and Territories, in all of which it is taxed, and that it could be justly taxed only on so much of its capital stock as wa represented by property in this State. The suit of the State was for about $480,000, taxes on the entire $80,000,000 of capital stock. We succeeded in cutting off all the stock distribution represented by earnings prior to the passage of the bill, but we were beaten on the position that only the stock represented by property in the State was taxable. We went to the Court of Appeals, and were beaten there also on this point. The Attorney-General and Controller both expressed the opinion that it was a great injustice and a public wrong, but the Controller insisted that he had no alternative under the law.

"In the meantime," continued Dr. Green, "we went to the Legislature last winter, and upon showing the manifest wrong done by the act of 1880 we secured the passage of an act making all taxes on corporations which had not been collected and were not in the form of judgments assessible only on the capital stock represented by property in the State. On this new basis we paid our taxes for 1882, 1883 and 1884, but the judgment for the tax of 1881 still stands, and it is on this that the execution has been issued. Now, what we claim is that the action of the Legislature was illogical and unjust, because if it is wrong to tax us for property on which we pay taxes in other States, as the new law admits, it is wrong to collect such unjust taxes where judgments have been secured, and wrong to keep money which has been collected under the law of 1880.

"The Controller did exact a pledge from us, as a consideration for his support of the bill of last winter, that we would not appeal from this judgment but would pay it, and our counsel agreed to this; but since the judgment was given we have discovered facts which had we been able to present them in court would, we think, have gained our case. We have found that, with the exception of a few mining companies whose property is all outside of the State, this is the only company that was taxed on the unjust basis of the law of 1880. Could we have shown this discrimination against us during the argument of the case I think the judgment would never have been given, and for that, among other reasons, I think that we are justified in refusing to pay it if we can avoid it. Our taxes under the law of 1885 amount to about $12,000, while under that of 1880 they were assessed at $170,000, which is quite a difference, even to so large a corporation as the Western Union. The difference is acknowledged to have been very unjustly levied, and we don't mean to pay it if we can help it."

A New Method of Propelling Vessels.

It is a number of years since the idea of propelling ships by forcing water out of pipes sternward took shape, and was in some instances put in practical application, and some recent trials on French war vessels have shown more favorable results than were previously obtained. Starting evidently with the same idea, Messrs. Samuel and John A. Secor, of Brooklyn, have devised an analogous method, which consists in forcing gases against the water, and thus establishing a means of propulsion.

The system will soon be given a practical trial, the ship with which it is to be made having recently been launched. She now only awaits her machinery.

The latter, of a most interesting character, is shown diagramatically in the accompanying engraving.

The method employed, broadly stated, consists in compressing a small quantity of air, which is then impregnated with petroleum spray. This is then exploded by an electric spark, and the large volume of gas generated is forced out at the stern.

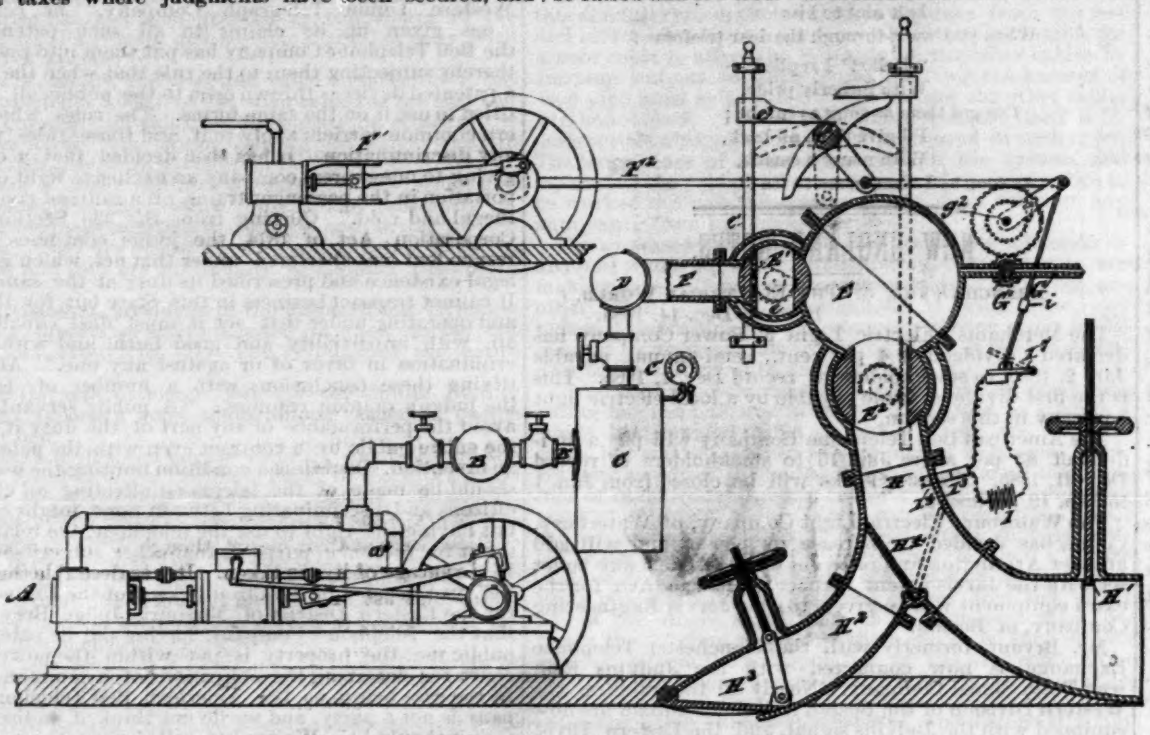
Referring to the illustration, the air-compressor is shown at *A*, pipes connecting with communicating reservoirs *B* and *C*. The air entering the combustion chamber *E* is controlled by an induction valve *E'*; on the stem of this valve is a toothed sector *e*, engaging with a toothed rack-bar *e'*, provided with a toe e^3. A rocker arranged on the shaft e^5, acts on the toe, raising and lowering it so as to cause the rotation of the induction valve *E'* for regulating the admission of air into the combustion chamber. The rocker is operated by means of a small steam engine and connecting shaft F^2. Leading from the combustion chamber is an eduction valve E^2, operated in a manner similar to the former. The ports of the valves *E'* and E^2 are so arranged that when one valve communicates with the chamber the other does not.

Petroleum or other hydro-carbon is forced into the combustion chamber through the pipe *G*, the valve *G'* regulating its admission, as will be easily traced, it being so arranged that it permits the escape of the petroleum only when the compressed air is admitted.

After the air has been impregnated the mixture in passing out is exploded by an electric spark generated by a battery *I* at the point I^4, the time of the spark being controlled by the make and break at I^3. After the explosion the gases rush out of the conduit *H*, which extends to the rear of the vessel and opens into the water.

The communication of the conduit *H* with the water in rear of the vessel is controlled by a valve *H'*, which may be raised and lowered. A branch conduit H^2 extends forwardly from the conduit *H* and communicates with the water below the vessel under control of a valve H^3. Another valve H^4 controls communication between the conduit *H* and branch conduit H^2. When the vessel is to be propelled forward the valve H^4 is thrown over against the upper end of the branch conduit H^2, the valve H^3 is closed and the valve *H'* is opened. When, however, the vessel is to have its forward motion quickly stopped, or when it it is to be backed, the valve H^4 is thrown over across the conduit *H*, the valve *H'* is closed and the valve H^3 is opened.

Petroleum being the fuel used, and only small quantities of it being required to form the explosive mixture, it is hoped to reduce the expense usually attending coal consumption to a minimum. It is expected that within a few weeks the boat will be ready for a trial, the results of which we shall give in due time.



A NEW METHOD OF PROPELLING VESSELS.

Quarterly Statement of the Western Union Company.

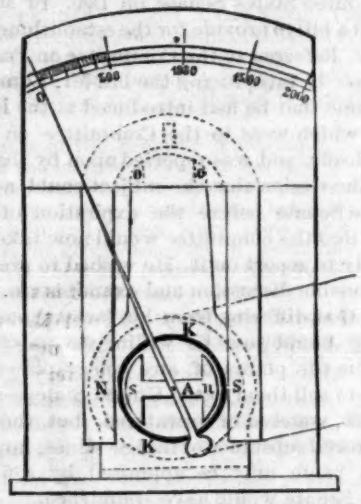
The Board of Directors of the Western Union Telegraph Company have issued their quarterly report for the quarter ending with the end of this month, estimating revenues for December. The last quarterly report showed a surplus on hand on July 1 of $4,324,004.11, and the net revenues for that quarter ended on Sept. 30 amounted to $1,250,568.67, making a total of $5,574,572.78. From this the report shows deductions of the last quarterly dividend of 1¼ per cent., amounting to $1,199,845.91, interest on the bonded debt amounting to $123,768, and a sinking fund investment of $20,000, making a total deduction of $1,343,613.91, leaving a surplus on Oct. 1, the beginning of this quarter, of $4,230,958.87. The net revenues of this quarter, based upon completed returns for October, partial returns for November, and estimates for December are placed at $1,250,000, which, added to the October surplus of $4,230,958.87, makes $5,480,958.87, from which are to be deducted the bonded debt, interest, and sinking fund allowance, amounting to $143,768, and the balance remains on hand of $5,337,190.87. Out of this comes the 1¼ quarterly dividend voted last week, which amounts to $1,000,000, and, according to the figures, a surplus still remains on hand, aggregating $4,337,190.87. "The estimate of net earnings for the past and present quarters," says the report, "have been materially reduced by the extraordinary expenses of cable repairs of both the Atlantic and Cuba cables, by large payments on account of litigated taxes, and for taxes in a number of the States, which are payable in the autumnal quarters, exceeding by about $400,000 the ordinary expenditures."

An Ingenious Electric Speed Indicator.

Various forms of continuous speed-indicators have been designed, based, for the most part, upon the action of centrifugal force, but we now have to announce the invention of a decidedly ingenious and practical *electric* speed-indicator. It is the invention of Dr. The. Horn, of Leipsic, Germany, and the instrument is based upon the well-known Arago experiment of causing the needle to be deflected in the same direction in which a copper disc above it is rotated, the deflections being proportioned to the speed of rotation. Since each speed corresponds to a certain deflection, the principle can be applied in a speed indicator.

The instrument is shown in the accompanying illustration, the weak directive action of the earth's magnetism being replaced by more powerful permanent magnets *N, S*. The needle is replaced by an I-shaped armature of soft iron, which is movable between the poles *N, S*. Instead of employing a disc, a thick cylinder or sheath of copper *K* is placed around the armature, which latter is far more affected than if a disc were used. Within the limits of 40° to 45° the deflections are proportional to the speeds, and hence the apparatus is a practical speed indicator.

The question naturally arises as to the constancy of the deflection with a certain speed when the strength of the directing magnet *N S* varies. If we assume that the magnet consists of two equal sheets or lamellæ, and imagine one of them to be removed, then not only will the strength of the poles *N, S* be reduced one-half, but those also of the armature *n s* will be similarly affected, provided the latter was not magnetized to saturation. Since the attraction between the poles *N s* and *S n* is proportional to the product of their strengths, the torsional moment between the armature and directive magnets for a particular position will only be one-quarter of the original.



ELECTRIC SPEED INDICATOR.

But it is easy to see that the deflecting power of the rotating sheath is also reduced to one-quarter of its original value, since with constant speed the currents generated are reduced one-half, corresponding to the strength of the poles *n, s*, the amount of deflection being the product of both. The forces acting with diminished magnetism are in the same relative proportions as originally; in other words, *the deflections of the armature* (and consequently of the pointer) *are independent of the strength of the magnets.*

This explanation, says Dr. Horn in the *Elektrotechn. Zeitsch.* is fully borne out by actual experiment. During the course of the latter, an electro-magnet was employed, the strength of which varied proportionally from 1 to 4, but with constant speed no perceptible change in the deflection was observed. Hence it may be asserted with confidence that any change which may take place in the strength of permanent magnets of the speed indicator will not affect the accuracy of the instrument.

Vanderbilt and the Western Union.

The range of possibilities in the acquisition of wealth in this country is remarkably exemplified in the career of William H. Vanderbilt, who began life in receipt of $16 a week, and who, when he died so suddenly, was in receipt of, it is said, $19.75 a minute. It might be said that he did not acquire all this wealth himself. This is true, but what was left him he managed to double, and that fact is no small testimony to his business capacity. Americans are outgrowing the old fear of large fortunes, and the reason is that even such wealth as Vanderbilt's is only a small and insignificant portion of the wealth of the nation, created by industry and by the development of manufactures, agriculture and commerce. It would certainly be better to have the wealth diffused instead of in

such large masses, here and there, in a few hands, but so far no way has been hit upon of preventing the rapid accumulation of large fortunes on the part of men of exceptional natural gifts for money making or enjoying unusual and rare opportunities. The problem of the distribution of wealth created by labor has yet to be worked out, and meantime it is matter for congratulation when the control of enormous wealth falls to a man of the late Mr. Vanderbilt's conservative temperament. It deserves note that practically none of Mr. Vanderbilt's wealth was invested in electrical enterprises when he died. But electricians will remember the time when Western Union was considered a Vanderbilt stock, and when Mr. Vanderbilt took an active though not brilliant part in running the company.

American District Telegraph Company.

For over a year past the public have noted the marked improvement in the messenger service of the American District Telegraph Company in New York, and, as a result, have given it patronage which has so increased its earnings that the company declared a two per cent. dividend at the last quarterly meeting, held on the 10th inst.

This is the first dividend the company ever paid on its earnings on a free rental basis; it being five years since a dividend was paid, and then it was paid from its receipts for rentals.

The capital of the company is $3,000,000. The dividend, therefore, calls for $60,000.

This is a glowing tribute to Superintendent G. V. B. Frost, under whose management it has, within two years, been brought out of debt and put on a substantial basis, and in better condition than it ever has been for paying dividends.

The Edmunds Postal Telegraph Bill.

In the United States Senate on Dec. 10 Mr. Edmunds introduced a bill to provide for the establishment of a postal telegraph. Referred to the Committee on Post Offices and Post Roads. In introducing the bill Mr. Edmunds said it was the same that he had introduced at the last session of Congress, which went to the Committee on Post Offices and Post Roads, and was reported upon by that committee so late in the session that the subject could not be considered by the Senate before the expiration of the session. He hoped that the committee would now take the earliest opportunity to report on it. He wished to press it to a vote after reasonable discussion and examination. It may be, he added, that differing from his former position on the subject, he should now be willing to purchase at their actual value the plants of any telegraph company that may wish to sell them to the United States—not the value of the stock, watered or unwatered, but the actual value of the material substance or things—lines, implements, etc. —as such value may be appraised by some tribunal in which the Senate would have confidence.

A Hundred Candle Power.

To the Editor of The Electrical World:

SIR: 1. Please inform me through your columns if 50 c. p. or less can be produced on a 100 c. p. incandescent lamp? 2. How many cells of 2 volts each will be required to produce 100 c. p., and how many of the same to produce 50 c. p. on the 100 c. p. incandescent lamp? 3. What kind of cells are best suited for the purpose?

MAMARONECK, N. Y. T. A. MANNING.

ANSWER.—1. Yes. 2. The data are insufficient. 3. It is difficult to say which is the *best*. The one described by Professor Dolbear in a recent issue seems well adapted to the purpose. Others adapted to the purpose will be found in our advertising columns.

Electricity in the Bar-Room.

A young man walking up Centre street hill, says a New York daily, halted when he heard a sharp "rat-tat-tat" on a big plate-glass window he was passing. He didn't see anybody's cane whisking out of sight over the carved oak paneling that stood a few feet behind the glass, so he turned away and was just moving off when the sharp rapping again stopped him. This time he saw what made the noise. A little metal button set edgewise on a thin wire was bobbing back and forth so lively that it seemed on the point of flying off. Beneath it was the picture of a chubby-faced little girl with red cheeks, glossy curls and a Normandie cap, whose eyes twinkled brightly as she smiled at every one passing by. A plain white sign surrounded the little girl and the busy, rattling button. It bore this comforting legend, "Hot Lunch To-Day."

The young man went inside the swinging wicker doors, and after extracting comfort from a preparation of malt, asked the white-jacketed bartender how the tapping was done. "It's the greatest scheme I ever saw," he answered, laughing at two small boys who flattened their noses on the pane at every vibration. "You see that little brown box over in the corner of the window? Well, that's chuck full of electricity. I saw the old man who runs the machine fill it up last week. Now, you see those two bits of wire that run into that clock. Well, the electricity gets into the clock on them and a wheel inside sets it on tap every five seconds; it's a circuit-closer, or somethin'; that's what the old man calls it. Then the electricity rattles that button just like a call-bell, and there you are.

"Pay $8 a month for the whole business, and it's the boss steer. All I want is to get the public in here once, and if I can't toss up coolers that'll keep 'em comin' in every day then I'll give up."

A Kiss Through the Telephone.

The telephone,
In merry tone,
Rang "Tinkelty, tinkelty-tink!"
I put my ear
Close up to hear,
And what did I hear, do you think?

"Papa, hello!
'Tis me, you know!"
The voice of my own little miss.
"You went away
From home to-day,
And you never gave me a kiss!

"It was a mistake;
I was not awake,
Before you went out of the house;
I thought that a kiss
Would not be amiss
If I gave it as sly as a mouse!

"So here goes, papa,
And one from mamma,
And another when you come home;
Just answer me this,
Is it nice to kiss
When you want through the dear telefome?"

"Hello!" I replied,
With fatherly pride,
"I've got them as snug as can be;
I'll give them all back,
With many a smack,
As soon as I come home to tea!"

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Dec. 14, 1885.

The Merchants' Electric Light & Power Company has declared a dividend of 4 per cent., semi-annual, payable Jan. 2, 1886, to stockholders of record Dec. 1, 1885. This is the first dividend made payable by a local electric light company in this section.

The American Bell Telephone Company will pay a dividend of $3 per share Jan. 15 to stockholders of record Dec. 31, 1885. Transfer books will be closed from Jan. 1 to Jan. 12, inclusive.

The Waterbury Electric Light Company, of Waterbury, Conn., has decided to increase its power, and will add another Armington and Sims engine, and one more boiler set with the Jarvis patent furnace. The contract for the extra equipment will be given to the Jarvis Engineering Company, of Boston.

Mr. Bryant, formerly with the Manchester Telephone Exchange, is now connected with the Judkins Railway Train Signal Company. Nearly all the trains on the Western Division of the Boston & Maine Railroad are now equipped with the Judkins signal, and the Eastern Division, and, in fact, all the branches of the Boston & Maine Railroad, will soon have this modern and useful signaling apparatus in operation on all the trains.

Wherever the Judkins Railway Train Signal has been put into use, the officials and train men of the different railways speak of the system in very favorable terms. The executive offices of the Judkins Company are at No. 54 Devonshire street, this city.

Gloucester, Mass., is to have a District Messenger service; and a local company has just been organized with a capital of $10,000.

The report comes from the capital city of Connecticut that the Hartford Electric Light Company is experiencing almost a phenomenal success with its system of arc lighting. From the first day after the installation of this plant, it has been conducted on a well paying basis. Although a new plant, it has in use 353 Thomson-Houston arc lamps, with orders in hand sufficient to carry the total to over 400, which will be burning before the new year is ushered in.

Mr. W. I. Capen, well known among telegraph operators, has been appointed Manager of the B. & O. Telegraph office in Hartford.

Mr. C. D. Warner, of Ansonia, Conn., recently extended his electric clock system into Shelton, a suburban township of Derby, and it has been successfully brought into use. Twenty-five clocks are made to beat in unison with the central system at Ansonia, several miles distant, and the subscribers are well satisfied with the service. By means of an electric gauge of his own invention and by other appliances, Mr. Warner has brought his system up to a fine degree of success.

The Electrical Supply Company, of Ansonia, Conn., have just completed a new wing to their factory building 76×41 feet in dimensions. This will largely increase the manufacturing and handling facilities of this pushing and enterprising concern.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, Dec. 14, 1885.

Judge Arnold—and a Philadelphia lawyer is famous the world over for laying down sound law—in awarding a mandamus on the Bell Telephone Company compelling it to grant telephonic service to the Baltimore & Ohio Telegraph Company, has brought into prominence, even if he has not actually decided, some important principles of the law relating to this modern electrical invention, the telephone. The decision is important because it settles temporarily all the discussion which has arisen in this State on this particular subject.

The suit was brought by the Baltimore & Ohio Telegraph Company against the Bell Telephone Company of Philadelphia; and the judge's opinion is of such interest to the electrical world at large that we may quote freely from it. The decision is well worthy of the study of every telephone manager in the country, and it is only want of space here that deters us from giving it in full.

The telephone company refused the application of the telegraph company for a telephone in the main office of the latter company, on the ground that by the terms of its contract with the American Bell Telephone Company it was prohibited from furnishing telephones to be used in connection with the transmission of telegrams to any company other than the Western Union Telegraph Company. Suit was brought in the Common Pleas Court, and a mandamus was prayed for requesting the telephone company to furnish the desired facilities to the complainant. In passing upon the case, Judge Arnold says: "It is admitted that the use of the telephone is a public necessity which no other human agency can supply. Consequently, the telephone business is a public business. To show that the refusal of the telephone company to furnish the relator a telephone for the purpose of receiving or delivering telegraphic messages is an unjust and unreasonable discrimination, it is averred that the respondent has placed an instrument in the office of the Western Union Telegraph Company, and permits that company and its customers to use the telephone for that purpose. The respondent alleges that it is the licensee of the American Telephone Company and subject in its dealings with the people of Philadelphia to the terms of the contract under which its license was given." The judge quotes at length from an agreement between the American Bell Telephone Company and the Western Union Telegraph Company to show that the latter is not a patentee which has granted a license for a restricted use of its patents to the telephone company, reserving a certain exclusive use to itself, but that it is a licensee paying to its licensor an additional compensation or royalty upon every message received or delivered by it. "The Western Union Telegraph Company," he continues, "has given up its claims to all such patents, and the Bell Telephone Company has put them into public use, thereby subjecting them to the rule that when the use of a patented device is thrown open to the public, all are entitled to use it on the same terms. The rules which govern common carriers apply to it, and those rules prohibit any discrimination. It has been decided that a contract giving to one express company an exclusive right of transportation in the passenger trains of a railroad company is illegal and void." Quoting from the 33d Section of the Corporation Act of 1874, the judge continues: "The respondent was chartered under that act, which gave it a legal existence and prescribed its duty at the same time. It cannot transact business in this State but for that act, and operating under that act it must deal equally with all, with impartiality and good faith, and without discrimination in favor of or against any one." After fortifying these conclusions with a number of decisions, the judge's opinion resumes: "A public servant cannot avoid the performance of any part of the duty it owes to the entire public by a contract even with the patentee of an invention. Doubtless a condition limiting the use which should be made of the telephone affecting all classes of citizens and discriminating between none, might be valid; but having the right to use the telephone, the relator may use it for the same purposes that other subscribers use it. In a case precisely similar to this, between the same parties, just decided in the Circuit Court of the United States for the Eastern District of Missouri, Judge Brewer held that the Telephone Company having put its patents into public use, the property is put within the power of the court for enforcing the obligations of a common carrier. In the case before us the American Bell Telephone Company is not a party, and we do not think it indispensable that it should be. We are not called upon to expound or enforce the contract between that company and the Philadelphia company. What we are called upon to do, is to declare that the illegal portions of that contract cannot be enforced in this way; that those portions are void and against public policy as declared both by the common law and by statute; and that the respondent cannot shield itself from the performance of its duty to serve the public impartially and without discrimination, by a contract with a party not within the State. We deal with parties carrying on a public business within our borders under the protection of our laws, to compel them to comply with those laws. They cannot obtain immunity from their obligation to treat all alike by pleading a license from parties beyond our grasp. The owner of a patent may put it in public use or withhold it, as he chooses; but if he does put it in public use, then, as was well said by Chief Justice McIlvaine of Ohio: 'The manner of its use may be controlled and regulated by State laws when the public welfare requires it.' The patent gives him a monopoly by protecting him from the competition of other persons in the business secured by the patent. But it does not permit him to make discriminations between persons who are willing to pay the same rates which other persons are charged for the same use. We say nothing now on the subject of charges by the respondent for the use of telephones except this: Whether it shall be an annual rental or a tariff of charges upon messages, it must be the same for all. A writ of peremptory mandamus is awarded."

The Bell Company has carried the case to the Supreme Court, and the final decision will be anxiously looked for.

Since the Western Union Telegraph Company and the American District Telegraph Company have parted, and do not speak as they pass by, the feeling has become very bitter between them, and the American District Company has buckled to the Baltimore & Ohio Company. The American District here is not famous for quickness, and as the same company "cut loose" once before from the Western Union—in 1874, when it joined hands with the ill-fated Atlantic & Pacific Telegraph Company—and was glad enough, three years later (1877) to get back again with the Western Union, it may be inferred now that the g. o. c. (grand old company) will not suffer much by the second desertion of its semi-political adjunct. To make matters worse, the American District, which never worked any more than indifferently, is now working a little more than not at all and a little less than fairly. Its wires have been heretofore strung on Western Union poles, and the latter company, well versed in the art of chopping poles and cutting wires, has been "removing" in grand style the lines of a company which has now become a "rival." This interesting subject will also be taken into court; but the curious fact remains that if two bakers bake in company, and subsequently agree to disagree, the junior partner can go into court to compel his senior to allow him (the departed one) to use still what was once the common oven. The Western Union clearly has a

right to throw the American District wires off its poles—for the latter company is now an adjunct of the Baltimore & Ohio—and the brave way in which sturdy Western Union linemen perform their arduous task bears evidence to their faith in the cause. "No partner of ours, no poles of ours," seems to be a fair doctrine. No man can inhabit a house and pay his rent to his landlord's opponent.

The Western Union main office is now nearly removed from Tenth and Chestnut streets to the new headquarters, the old Tabernacle Presbyterian Church, at Broad street and South Penn square. The building will not be finished until January. Some repairs will yet be made in the auditorium and galleries, which are used as the operating room. The auditorium has a floor space of fifty-one by sixty-four feet, and the galleries give about half as much. The ceiling is twenty-five feet high, and Superintendent Gill says that the room is the handsomest in the country, and the best ventilated and best lighted. The front part of the building, which is not yet finished, will be the Receiving Department. It will be connected with the operating room by pneumatic tubes. Back of it is a comfortable room for the messengers. The third floor in the front part of the building will be used by the Associated Press. The building is intended for temporary use only. In a few years it will be torn down, and in its place a handsome five or six-story building will be erected.

Prof. George F. Barker has recommended to the Public Building Commission, as a protection to the 500-foot tower of the new City Hall from lightning, that two complete and continuous metallic conductors be placed on the tower from the base to the summit. He also suggested that the flagstaffs now erected on the pavilion be made to terminate in a number of sharp points. The metal of these points should have a high conducting power and a high point of fusion, not readily acted upon by atmospheric influences. The metal most available is said to be malleable nickel.

A charter has just been granted at Harrisburg to the Bloomsburg (Pa.) Steam and Electric Light Company, with a capital of $40,000.

Alfred F. Moore, the wire and cable manufacturer, has just completed a 1,500 foot 100 wire cable for the Bell Telephone Company, of this city, to be used in crossing the Delaware River. Mr. Moore has an extensive trade in this line, and his work gives great satisfaction.

Partrick & Carter are making extensive alterations and improvements in their store room, their constantly increasing business necessitating larger and better lighted quarters. They are one of the live, enterprising firms in this line, and they are continually developing something new.

W. T. Griscom, president of the Philadelphia Dynamic Company, reports an active demand for their goods, not only in and about the city, but throughout the entire country.

James Garnett, manager here for the Shultz Belting Company, reports a good trade among electrical people for their belt.

The small high-speed engine recently exhibited at the Novelty Exhibition, by Burnham Bros., of York, Pa., and built by the Christiana Machine Company, Christiana, Pa., is attracting considerable attention among people contemplating the use of a small engine for electric light purposes. It was used at the Novelties to run the electric light for illuminating Wanamaker's Christmas tree.

The Northern Electric Light and Power Company, which furnishes light for the northern part of the city, has declared a dividend.

Schleicher, Schumm & Company, the manufacturers of the Otto Gas Engine, report the sale of several engines for use in electrical work.

The Main Belting Company report several sales of belts for electric light work by their Western agent. This belt has many good features and is well spoken of by those who have used it.

The *Ledger* says, "Thieves have at last managed to break into a Chestnut street store from the front, notwithstanding the protection afforded by the electric lights. This is the *first* case we have heard about, of such a robbery on Chestnut street since the electric lights were introduced, and it would be worth while to make a close inquiry as to how it could have been effected." This seems to open up an entirely new line of argument, why the electric light should be established on all thoroughfares.

As Christmas approaches, the electric light is brought into great use in displaying the elegant holiday goods to be seen in the windows of the different large stores on Chestnut street. The Temple Theatre, using the electric light, has an Edison plant, which supplies the entire light for this large place of amusement, and gives much satisfaction both to the audience and proprietor.

The Phœnix Iron Company, of Trenton, are putting in several engines for running electric light plants. These engines are highly spoken of, and I learn from those who are conversant with their merits that they are splendidly adapted for this work.

Mr. Stuyvesant, who is the manager for the Cornish Bell Company, and also the agent here for the Western Electric Company, reports business good. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Dec. 12, 1885.

Two conduit companies are asking the city of St. Louis for a franchise under which to operate in that municipality. These companies are the Dorsett Company, of Chicago, and the Chisholm-Patterson Company, of the same place. The St. Louis city officials, having heard the arguments and flow of vituperation of the two companies, decided, in order to gain further information, to send a delegation to Chicago for the purpose. This delegation arrived this morning, forty-seven strong, among the gentlemen composing it being the following:

George W. Allen, President of the Council; E. P. Fox, Chairman House of Delegates; Members of the City Council—W. J. Blakely, William F. Haines, P. O'Malley, Joseph Temple; Members of the House of Delegates—Peter R. Morrisey, John Vogel, George Wenzlick, Christopher Fischer, Louis Kohlbry, Henry Alt, Julius Lehmann, J. J. Coakley, H. A. Pishan, T. J. Kaye, Patrick Monahan, Charles D. Keenan, Charles Schoenbeck, Peter Gundlach, James M. Sullivan, George H. Brueggemann, M. R. Collins, William Gartenbach, E. F. Stone.

The delegation spent the forenoon in examining the Dorsett conduit system, as it is in operation in Chicago. It is not necessary in this report to say much concerning the Dorsett conduit. The system has been illustrated and described in THE ELECTRICAL WORLD, and is well known. It has been extensively in operation in Chicago for some time, and has given quite general satisfaction. It is now under consideration for adoption by several cities.

After finishing their investigation of the Dorsett conduit, a meeting of the delegation was called at the Grand Pacific Hotel at 3:30 P. M. Before this meeting appeared City Electrician Barrett and Mr. Cushing, Superintendent of the Chicago Sectional Underground Company. The delegates asked these gentlemen a large number of questions concerning the working of underground conduits in Chicago, and conduits generally. These experts, however, preferred to confine their remarks mainly to what a conduit *should* be, and in this way avoided expressing any opinion as to the merits of the two systems under discussion. After a very short session, carriages were taken for the factory of the Western Electric Company, where the Chisholm-Patterson conduit was examined.

The conduit mentioned is the joint invention of Dr. J. W. Chisholm, the Brooklyn capitalist, who is quite largely interested in electric lighting, and Mr. W. R. Patterson, of the Western Electric Company, the inventor of the well-known Patterson cable.

The invention of this conduit was suggested by a desire to avoid the frequent explosions resulting from gas escaping from leaky joints and collecting in the large open spaces formed by the manholes. Without manholes or similar large underground spaces, there can be no serious explosions, and the important claim made for the Chisholm-Patterson conduit system is that it makes manholes unnecessary. It is also claimed that the system is more flexible in its adaptability to varying conditions, resulting from the fact that with this system obstructions are easily got around, while with other systems under the same conditions their removal would be necessary.

Each cable must also stand on its own merit, as with this conduit system each cable is separate from the rest and surrounded by an iron pipe. It is thus impossible for a poor cable to affect the working of the other cables by burning out, as in order to do this two thicknesses of iron pipe must be passed through before the other cables can be reached. The material of the conduit itself is indestructible also, and comes out uninjured in such cases. The large mass of metal employed in the system, and separating the cables, allows all kinds of electric service to be worked through the same group of pipes without any annoyance from induction.

The avoidance of manholes also makes the collection of dirt and water in same impossible; avoids delay in not making it necessary for one gang of men to wait for another, when work at the manholes is being done, and makes it impossible for one company having wires in the conduit to accuse another having wires in the same conduit of interfering with its lines.

This conduit is composed of a group of non-communicating independent iron tubes, each designed to contain a single lead-covered cable or wire. There are no manholes, but access is gained to each pipe at a separate place. By thus avoiding the manholes common to all the openings of other systems, each cable or wire is entirely independent of every other. Work can be performed on all the cables simultaneously, if desired, either splicing, testing or drawing in, which is impracticable when the only point of access to all the cables is a common manhole. A leaky pipe allowing the entrance of gas does not affect any of the others, since there is no communication between the different pipes, and there can be no such serious explosions from the accumulation of gas as is common in conduits with large manholes. There is no danger to other cables from the grounding of an electric light wire, since the blaze cannot reach them, and before it could heat the mass of metal in the two thicknesses of pipe separating it from every other cable sufficiently to cause injury the current would be shut off.

The conduit is not limited to any fixed shape or dimensions, as the pipes can be arranged in whatever way is most suitable for that particular place, and they can be bent around catch basins or hydrants and over or under service pipes. The preferable location of the conduit is within the sidewalk space; where there are excavated areas they can be attached to the curb wall.

There can be no valid objection from property owners to this arrangement of pipes, as there is absolutely no danger from fire, and after the pipes are laid there is no need of workmen entering that basement again, except for work in connecting or disconnecting the service wires for that particular building.

In such areas the pipes designed for electric light wires are united by a special fitting, completely covering and protecting the inclosed wire, but easily removable in case a loop is desired to be run into the building. The pipes carrying the main telephone and telegraph circuits need not be accessible at such frequent intervals, but only at such points as are needed for drawing in the lengths and making the constant necessary splices. All the wires for a block may very readily be brought singly to such points and there taken into the main cable.

In case the areas are not accessible the pipes may be laid in the ground within the sidewalk space, against the inside of the curbstone where practicable, but can be laid under the pavement of the streets as easily as any other conduit. When thus buried, each pipe, at points where access is desired to the cable or wire to be contained therein, is bent upward to the surface and such point marked and covered by an iron case not much larger than is required for the shut-off cocks of gas and water pipes. When this cover is removed the special fitting joining two adjacent ends of a pipe is exposed. By removing this the ends of the pipes are rendered accessible, and cables or wires may be drawn in, spliced or tested, or loops taken out.

It is designed to lay the pipes, especially those intended for electric light circuits, on both sides of the street, so the entire length of wire may be utilized for supplying lights, thus avoiding the long stretches of unproductive wire necessary when a simple conduit in the street is used, with laterals from the manholes at street corners only.

The entire system has been well worked out, and is being amply protected by patents.

After finishing their examination of the conduit, an adjournment of the delegation was had to supper, and afterward to the theatre. Some further information in regard to the two systems was obtained the morning of the 13th, after which the delegation left for home.

It is hard to say which system the committee will recommend. The Dorsett system has the advantage of being in actual operation, while the Chisholm-Patterson system is, to a certain extent, yet experimental. It is claimed by the latter company, however, that they have profited by the mistakes of the former, as is shown by their avoidance of manholes.

A point which will probably cut quite a figure is the fact that St. Louis has lately repaved in the best possible style the greater part of her streets. To use the Dorsett system would involve the tearing up of a good deal of their new pavement, and this the St. Louisians have little desire to do. It is possible that the Chisholm-Patterson system, which is accommodated by the sidewalk area, will derive a little benefit in the final outcome on this account. W. A. K.

SEATTLE, Wash. Ter., Dec. 7, 1885.

The Union Iron Works, of San Francisco, manufacturing and controlling the Keith system of electric lighting for the Pacific Coast, have a dynamo for arc and incandescent lighting on exhibition at the Mechanics' Fair, at Portland. The exhibition is in charge of Mr. Blaisdell, who expects to organize a company there to operate the Keith system.

The Edison plant on board the Oregon Railway & Navigation Company's steamer "Olympian" was recently given a thorough overhauling by Messrs. Mitchell & Sparling. The O. R. & N. people are very much pleased with the Edison light. The Brush plant formerly used in the foundry and machine shops of Smith Bros. & Watson, of Portland, has been shipped to Spokane Falls, W. T., where it will be placed in the "C. & C." flour mills and be used to light the streets of that city.

The Seattle Electric Light Company was recently organized in this city, with a capital stock of $50,000, for street and domestic lighting, under the Edison system. The Edison "Municipal" dynamo will be used for the streets. The work of making the installation will be rapidly pushed forward under the superintendence of Messrs. Mitchell & Sparling, and the company expects to commence operations in the early part of January.

THE TELEGRAPH.

Fraternal Feeling.—The Chicago telegraph operators very generously made up a purse for the sufferers by the Galveston fire, the funds to be presented to the ten telegraph operators at that place who were losers by the fire, several of whom have families.

A Sale in Baltimore.—The entire effects of the Postal Telegraph and Cable Company in Baltimore were sold at auction last week, and realized about $550. The sale included all the telegraph instruments, battery, ten miles of wire and 300 messenger call-boxes, and a horse and buggy. Much of the property was bought by junk dealers. The Bankers and Merchants' is advertised to be sold next week.

"The Genesis of the Electric Telegraph."—This was the subject of the lecture delivered by Mr. T. D. Lockwood at Boston, last week, in his series before the Lowell Institute. He reminded his audience that it was in Boston that Franklin and Morse were born, and in Boston that Bell made his great discovery in telephony. The local press reports show the lecture to have been of a novel, able and interesting character.

Paving the Ocean.—The certificate of incorporation of the Southern Telegraph & Cable Company was filed in the County Clerk's office on the 14th inst. The incorporators of the company are Edward S. Stokes, Cassius H. Read, Dwight Townsend, Edward Lauterbach, O. A. Lochrane, Elgin Lochrane and Patrick Calhoun. It is to do business throughout the United States and Canada, and to lay ocean cables to the coast of Ireland, to Penzance and London, England, and Paris and Brussels. Its capital stock is $10,000, divided into 100 shares, with liberty to increase it.

THE TELEPHONE.

A Perpetual Injunction.—At Pittsburgh on Dec. 10, in the United States Circuit Court, in the case of the Bell Telephone Company against the Western Pennsylvania Telephone Company, Judge McKennan decided that the defendant instrument was an infringement of the Bell patent, and granted a perpetual injunction as asked for by the Bell Company.

The Edison Patent in Canada.—The taking of evidence before the Deputy Minister of Agriculture, on the application of the Telephone Manufacturing Company of Toronto, has been concluded and decision reserved. The application is to have the Edison telephone patent, now held by the Bell Telephone Company, declared void because of the importation, non-manufacture and refusal to sell by the Bell Company. The Bell patent proper was annulled last year, but the Edison patent still holds good, and, as the Bell Company has brought an action against the Telephone Manufacturing Company for an infringement of the last-named patent, this application is made to set it aside.

THE ELECTRIC LIGHT.

Four Per Cent. Dividend.—The Merchants' Electric Light and Power Company, Boston, has declared a semi-annual dividend of 4 per cent., payable Jan. 2.

St. Louis.—Articles have been filed by the St. Louis Thomson-Houston Electric Light Company, making an increase in their capital stock from $100,000 to $150 000

PERSONALS.

Mr. Wm. F. Chester, General Manager of the Mutual District Messenger Co., of Washington, D. C., was in this city last week. He reports business very active at the capital.

Mr. J. Frank Morrison, the President of the National Electric Light Association, is one of the bibliophiles of the profession. It may be doubted whether any private individual in this country, except perhaps Professor Bell, has a finer general electrical and scientific library than Mr. Morrison, who not only buys with taste and judgment, but with that forcefulness which is one of his most prominent characteristics, and which will let nothing stand in his way when he is bent on purchasing some valuable prize in electrical literature that has come on the book market. Mr. Morrison is to be congratulated on his possessions, as well as on the other relics he has of the early days of electricity in America, especially as connected with Baltimore his place of residence. To hear Mr. Morrison enumerat'

modestly what he has accumulated is enough to make any electrician break the tenth commandment.

The Morse Family.—Speaking of Susan Morse, who is now supposed to have thrown herself overboard in a fit of insanity, the Rev. Richard C. Morse, a nephew of Samuel F. B. Morse, and editor of the New York *Observer*, says that she was a daughter of Professor Morse by his first wife, a Miss Lucretia Walker, of Concord, Mass. She was born about 1820, and about 1839 married Mr. Lind, by whom she had one son, who studied art and died abroad. Mr. Lind died several years ago, and his widow has resided recently in the West Indies. Mr. Morse did not know that Mrs. Lind had resumed her maiden name. Professor Morse had a daughter Lena by his second wife, who was a well-known belle in New York society. She married Anton Rubinstein, the musician, and lives in Berlin. Mrs Morse, widow of Professor Morse, is now abroad with her youngest son, Edward. Prof. Antonio M. Molia, of this city, and a native of Porto Rico, says of Mr. Lind's plantation at Arroyo: "Here Mr. Morse came while yet the electric telegraph was ticking only in his own imagination. In the quiet of Mr. Lind's palatial residence he thought out his invention. Mr. Lind had an office in the town of Arroyo. Mr. Morse had a wire strung from the plantation to this office, and over that wire, in the little Spanish colony of Porto Rico, the first message ever sent by electricity flashed its way (*sic*). The Porto Ricans are very proud of this and say that the Yankees are clever fellows, but they had to come to Porto Rico to invent the telegraph. And yet, strangely enough, the country in which the first telegram was sent was among the last countries to adopt the telegraphic system."

MISCELLANEOUS NOTES.

Attraction.—"You are the magnet and I have an armature," said he. "How is that?" asked she. "An arm at your disposal," answered he.—*Rockland Courier.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Dist., a 35; B. & M., b 3, a 3; Western Union, b 72⅜, a 72¼.

Telephone.—Am. Bell, b 173, a 175; New England, b 29.

Electric Light.—The *Miscellaneous Security Report* says: Edison Electric Light stock has boomed up from $50 per share to $176 bid, and it is still said to be cheap.

BUSINESS NOTICES.

[Copy.]

W. H. GESNER, SUP'T.

OFFICE OF
THE BRUSH ELECTRIC LIGHT AND POWER CO.,
MONTGOMERY, Ala., Nov. 17, 1885.

Messrs. Giles, Bro. & Co., State and Washington Streets, Chicago, Ill.

DEAR SIRS: I have to acknowledge receipt of my watch with magnetic shield. Please accept my thanks.

I have given the watch a thorough test—held it all about the field magnets of a No. 8 Brush machine, running at 750 rev. per minute and supplying 52 arc lamps, without visible effect.

I consider your magnetic shield a perfect protection from magnetism.

I have ruined three or four watches heretofore, and have spent money enough for repairs to buy a dozen shields almost. Very truly yours,

W. H. GESNER, Sup't.

Electric Novelties.—Otto Rauda, of 181 William street, will send to any address his catalogue of electric novelties, all of which are excellent.

Prize Belting.—The "Electric" leather belting of Charles A. Schieren & Co. has been awarded the bronze medal of superiority, at the last (54th) annual exhibition of the American Institute.

Holiday Gifts.—Electricians, book-keepers, etc., wishing to invest a small amount in an appropriate holiday gift will do well to address Messrs. J. Ullrich & Co., of 106 and 108 Liberty street, for their circulars.

A European Agency.—The Thomson-Houston International Electric Company, of Boston, has opened a European agency at Brussels, Belgium, 74 Boulevard du Nord, under the care and supervision of Mr. James F. Meech.

The New York Electric Company, 737 Broadway, N. Y., have bought out the Portable Electric Company, of Boston, manufacturers of the Dynamo Electric Gas Lighter. They (the N. Y. Electric Co.) are now the sole owners and manufacturers of this Gas Lighter, and are prepared to fill all orders. Liberal discount to the trade.

Elizabeth, N. J.—The Electric Light Company, of Elizabeth, N. J., has so far progressed with its plant as to be able to light up its building with incandescent lamps, and it will this week light the city with the Thomson-Houston system. Pope, Sewall & Co. are to be congratulated on the rapid and thorough manner in which they have constructed this plant.

Dean's Rheumatic Pills

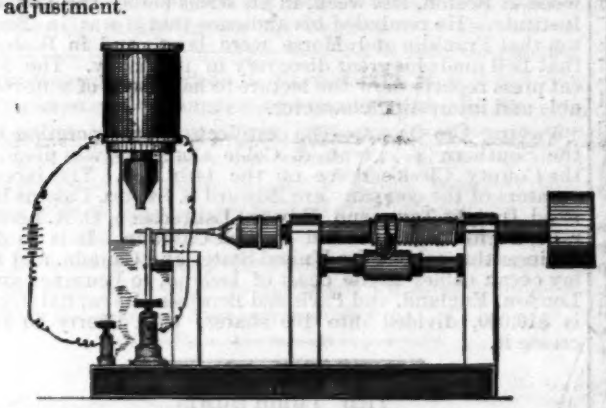
Are a sure cure, a superior remedy, almost infallible; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown, 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DECEMBER 1, 1885.

Telephone; William C. Lockwood, Brooklyn, Assignor to Thomas Wallace, New York, N. Y.... 331,309

Consists in a telephone having set electrodes which are normally held in operative contact by counteracting devices, which act axially, one tending to force the electrodes apart and the other tending to press them together, the latter slightly preponderating and capable of delicate adjustment.



331,386. METHOD OF STRAIGHTENING NEEDLES, WIRE, ETC.

Arc Lamp; George C. Pyle, Cuyahoga Falls, O., Assignor to the American Headlight Co., Indianapolis, Ind.... 331,327

Consists of details whose elements are a base, a reflector, a plate attached to said base and carrying the working mechanism of an electric arc lamp whose carbons are located within the reflector, said plate being pivotally attached to the base and provided with a clamping-screw, as described, whereby the plate can be secured at different points about the pivot and the carbons adjusted within the reflector.

Municipal Telegraph Apparatus; John C. Wilson, Boston, Mass., Assignor to the Municipal Signal Company, Portsmouth, N. H.... 331,356

Consists in a box containing signal-transmitting mechanism having two independent operating devices, one for sending a signal, called the "main" or "box" signal, and the other for sending the said main signal, in connection with any desired one of a series of special signals, combined with a local audible signal or alarm, and mechanism whereby it is set in operation when the box or main signal is sent. The box has a door, called the "citizen's door," affording access to the device for transmitting the box-signal, the said door being provided with a latch, and means to produce a local alarm, when the said latch is operated to permit the door to be opened, on the signal-seat.

Straightening Needles, etc.; George M. Eames, Bridgeport, Conn.... 331,386

As shown in the cut, it consists in revolving the object to be straightened across the path of the straightening mechanism, and in controlling the operation of the straightening mechanism by the eccentricities of the object to be straightened.

Secondary Battery; Edward Jones, Leeds, County of York, England.... 331,407

Consists in uniting strips, ribbons, or wires of metallic lead or lead alloy to a metal backing of similar material by submitting the said strips, ribbons, or wires, held fast by chilling-clamps, to the molten backing metal contained in a mold, whereby the liquefaction or partial liquefaction of the said strips, ribbons, or wires beyond their points of junction with the backing is prevented.

Carbon Baking Box; William J. Possons, Cleveland, O.... 331,440

Comprises a supplementary or false bottom, supported by suitable ribs a slight distance above the bottom of the box, and upon which the ends of the carbons rest. It serves to equalize the heat and prevent the burning of the ends of the carbons.

Electric Signaling Apparatus; Jacob P. Tirrell, Boston, Assignor by direct and mesne assignments to James F. Emmerson, Wakefield, George O. Carpenter, Boston, and John W. Carter, Newton, Mass.... 331,463

Comprises a flexible strip having notches arranged in conformity to a schedule or time-table, combined with mechanism for moving said band progressively at a predetermined rate, so that each notch will be in a given position at a given minute, and an electric circuit, including a signaling device and having terminals which are separated by the imperforate portions of the band, and are permitted to meet and close the circuit through the signaling device by the notches of the band.

Armature for Dynamo Electric Machines; Charles T. Jackson, New York, N. Y., Assignor to the Hecla Electric Light Co., of same place.. 331,502

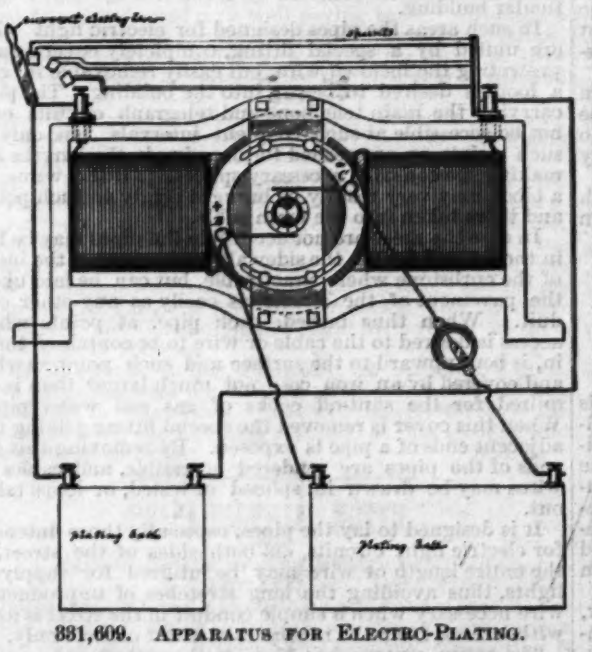
Consists in an armature formed of iron wires placed on discs on a shaft parallel with the said shaft, which wires are bound together by wires placed circularly around them, and are then covered with insulated copper wire.

Dynamo Regulator; William M. Schlesinger, Philadelphia, Pa.... 331,552

Consists in taking a loop or branch from the main conductors, placing a solenoid or magnet therein, the core or armature of which acts upon switching devices, one part of which is also controlled or operated by a solenoid or magnet in circuit with one of the line conductors, either or both of which act to change the direction of the current to and from a current regulating device in circuit with the field-magnet coils of the dynamo, whereby the current generated by the dynamo is never permitted to rise above a desired point or limit.

Contact Device for Suspended Electric Conductors; Charles J. Van Depoele, Chicago, Ill.... 331,585

He employs a movable contact wheel and improves the details of construction in practically applying the same.



331,609. APPARATUS FOR ELECTRO-PLATING.

Electro Plating; Herman R. Boissier, New York, N. Y.... 331,609

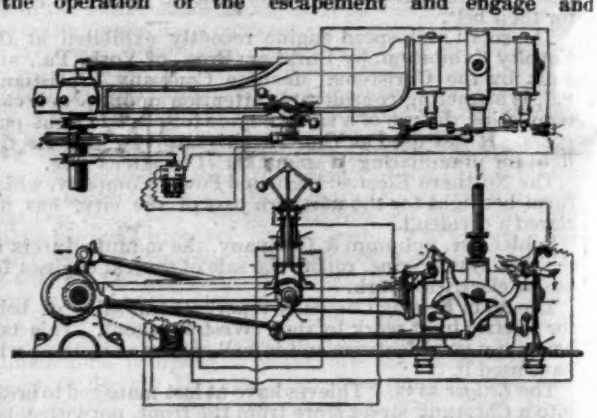
As shown in the cut, the system consists of a dynamo electric machine, two plating baths and two electric circuits, one of which includes one bath, the field magnets and the armature, and the other the armature.

Electric Gas Lighter; John Geary, Philadelphia, Pa.... 331,630

Consists of an armature pivoted to or hinged upon one of the requisite limbs, said armature carrying an electrode at one end and having a retracting-spring and adjusting-screw at the other end.

Electrical Indicator; Chester H. Pond, Brooklyn, N. Y.... 331,650

Embraces the combination with the electro-magnet, the escapement-anchor connected to the movable member thereof and vibrated thereby, and the escapement-wheel; of a locking device, operating independently of the magnet, and adapted to act upon the cessation of the operation of the escapement and engage and



331,674. ELECTRO-MAGNETIC CUT-OFF FOR ENGINES.

lock the escapement-anchor, thereby preventing further vibration thereof and further advance of the indicating mechanism after the latter has reached the proper character, and rendering impotent any further excitation of the magnet.

Method of Carbonizing Filaments for Incandescent Electric Lamps; Edward P. Thompson, New York, N. Y.... 331,663

The object is to provide means for preparing a large number of filaments for carbonization at the same time, for subjecting them by a single operation to the carbonizing process, and for insuring that they shall all be of the same size, form and degree of perfection. Consists in winding the filaments upon a block of refractory material, holding the said filaments to the form by winding a ligature about the same, severing the filaments at one or more points, inclosing the whole within a crucible or kiln, and subjecting the same to heat.

Electro-Magnetic Cut-Off for Engines; Richard A. Bailey, Providence, R. I.... 331,674

As shown in the cut, it consists of a suitably-mounted lever adapted to receive reciprocating or vibratory movement, and carrying one or more electro-magnets, adapted in turn to magnetically connect with the valve-lever, which also forms the armature, the electrical current used in connection therewith being generated by means of a battery or a dynamo-machine.

Dynamo; Hermann Müller, Zurich, Assignor to the Werkzeug und Maschinenfabrik Oerlikon, same place, Switzerland.... 331,726

The armature has the conductors wound upon it in one continuous course, so that the distance between each two successive induced portions of the conductors is greater or less than that between the poles of the field-magnets, according to the formula

$$D = d - \frac{n}{p} \text{ or } D = \frac{n}{p} - d.$$

Call Box; James F. Kettell, Worcester, Mass.... 331,718

Embraces a current-generator, a driving-shaft for imparting motion to the generator, a circuit making or breaking wheel electrically connected with the line, a mechanical power for driving the circuit-wheel, a stop device for arresting the movement of the circuit-wheel at each full revolution, and a projection carried by the said driving-shaft for actuating the stop device and releasing the circuit-wheel upon the revolution of the shaft and the energizing of the current-generator, the whole constructed to act in combination